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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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THE ENGINEER IN THE LABOUR FORCE

An address to the Montreal Branch of The Engineering Institute of Canada, Montreal, November 15, 1951.

by

The Hon. Milton F. Gregg

Minister of Labour
Canada

The role of the engineer in the Canadian labour force is an important one. This fact is not so obvious when we look only at the numbers involved.

Of Canada's total labour force of more than five million, only about 30,000 of these are engineers—that is to say, little more than half of one per cent. But engineers are keymen and affect the work and the welfare of many people.

Demand for Engineers

Although the overall total of engineers in our economy is still small, your group has been growing rapidly in comparison with others in the country. In 1900 the proportion was less than one engineer for every 2,000 Canadians; at present it is more than one for every 500.

This growth is due to the continued advance of technology. The first half of the 20th century has seen in Canada a great expansion in electric power, in the chemical industry, in the scientific search for minerals, in woods products, and in construction projects required by modern industry. All these have brought a steady increase in the demand for the engineer in industry, in government service, in management, and in education.

Our defence program has added still further to that demand. The magnitude of Canada's share over the next twelve-months is reflected in the estimate of one and a half billion dollars. To this will be added, during the next few years, a high rate of investment in hydro-electric power and in capacity to produce such basic materials as steel and iron ore, petroleum and non-ferrous metals. This essential investment, partly public and partly private, is expected to average approximately half a billion dollars annually until 1955. The expansion of our basic industries, the organization of defence production, and the needs of the technical branches of the armed forces all add to the demand for engineers.

Position of the Engineer in the Labour Force

You occupy a strategic position in the labour force. From the technical aspect your position is acknowledged without question: It is you who bridge the gap between science and industry. You convert laboratory experiments and blueprints into practical production.

It is another aspect of the engineer's position which I wish to emphasize now. This is your relation to the other members of the working force. Maximum production can be obtained only when to technical and scientific competence is added the co-operation of this working force. Buildings and machines, though these be the last word in efficiency, cannot produce without co-operating human beings—men and women with brains to think, eyes to see, hands to perform, and hearts to trust. The successful engineer today, therefore, is one who fully realizes the importance of the human factor in production.

Composition of the Labour Force

The Canadian labour force in recent months has reached a record of nearly five and a half million people. There are nearly ten million people in Canada aged 14 years and over, so that about 55 per cent of them are in the labour force—that is, they have jobs, or are looking for jobs. Included in that figure are almost all men between the ages of 20 and 65, plus a considerable proportion of those younger or older. Women, of course, are more likely to be working in their later 'teens and early twenties than at other ages.

During the last war—and since—we have frequently been concerned as to whether our labour force would be adequate to produce all the things we need. This concern has now been intensified by our new defence program. Of course, it is appreciated that that potential can be stretched considerably. We saw during World War II just how elastic it was. We remember that the armed forces absorbed at their peak about one-seventh of our total labour force. But, notwithstanding that, the number of civilian workers available decreased only slightly. That was because a great many additional people were drawn into labour from the outside. These included married women, men who had retired, students recruited for summer work, and various other groups.

Since the end of the war, we now add immigration as an important source. However, our labour potential is not infinitely elastic. During the war, our requirements were met only by great efforts, including intensive campaigns to recruit workers for agriculture and industry. These were supplemented by orga-

ized seasonal shifts of workers of ertain types, and by comprehen-ive controls on the use of man-ower.

Moreover, two labour reserves which in 1939 were available have ow been almost used up. The first vas the unemployed, which was ery large then but now is fortun-tely at a low level. The second was arm-workers, which provided everal hundred thousand men for he armed forces and for industry; ut which is now itself in very hort supply.

There is therefore a continuing ask—one of maintaining an ade-uate reservoir of qualified workers. 'hat is something which has com-anded the practical sympathy and upport of the Government. We re, as you know, assisting by everal means. I would cite the overnment's vocational training rograms, the increased immigra-on, and, may I add, the speedy lacement of workers in suitable obs through the National Employ-ent Service.

Training of Skilled Labour

The requirements of the defence rogram, begun at a time when abour of most kinds was already lly utilized, have created some hortages of certain key types of killed labour. This gives special nportance at this time to vocational aining, which is conducted by my epartment, in co-operation with e Provinces. Not so long ago this ndertaking was looked on almost xclusively as one to assist younger eople to secure or to improve their nployment, by equipping them ith some definite trade or skill. 'he scope of the program has been ery greatly extended. Obviously, e same machinery can be used to evelop a more adequate supply of orkers with specialized training mong those who have hitherto ot had that advantage; and it is eing so used.

The name "Canadian Vocational 'raining" is quite likely to be ssociated in many minds only with ch institutions as technical and ocational schools at the secondary vel of education. Its scope is much roader. During one recent year nancial assistance was granted to ver 2,000 students at university, cluding approximately 400 in engi-eering. The aid was granted to ose who had good academic stand-g but who could not continue their urse without financial help.

These operations are carried out o-operatively with the provinces. suggest that this is a sphere in which definite and practical steps are being taken to safeguard future supply.

Adequacy of Supply of Engineers

The mention of current shortages of skilled labour brings us to the question of graduate engineers. Is the present supply adequate? What is the outlook for the future?

Any present shortage of engineers in Canada is largely confined to the realm of specialization, to cases where a man with a definite type of experience is required for a specific project.

It is difficult to estimate the extent of this shortage, but probably there are several hundred such vacancies at the moment.

One must remember that of the 30,000 engineers in Canada half are young men who have graduated from universities during the last decade. This includes the very large group of veterans who have graduated since the war.

The present shortage of experienced engineers will therefore be eased as this large number of recent graduates gains experience, and the more competent of them are promoted to positions of responsibility.

There remain the needs of the future, for which we must provide. That can be done by encouraging enough students to enter engineering schools in the years just ahead. It has been estimated, conservatively I think, that Canada will in future require annually about 2,000 graduates in engineering.

The yearly output of graduates is now dropping rapidly, as the war veterans finish their courses. By 1954 the level will fall to only about 1,200. Efforts must be made to increase this number, without, however, lowering in any way the standards of our engineering schools.

There is scope here for co-operative effort. You in the profession, ourselves in the Government, the educational authorities, industry and other professional organizations must accept this as a joint endeavour. Regarding the part of the Federal Government, for some years it has been extending aid to university students under the Canadian Vocational Training program. We have also recently established a system of grants to Canadian universities in accordance with a recommendation of the Massey Commission.

Professional men are already doing much to counsel and assist potential students. In this connection I need only to point to the contribution of the Engineering Institute of Canada in co-operation with the Canadian Institute of Mining and Metallurgy and the Chemical Institute of Canada. By joint efforts, these organizations have already erected a framework of counselling machinery which reaches all parts of the country. Each has devoted an important share of its activities to the student and the young professional man.

Of particular interest to my Department is the joint action taken in the name of the Canadian Committee for Student Guidance in Science and Engineering (E.I.C., C.I.M.M., C.I.C.). It enabled our Economics and Research Branch to publish a comprehensive monograph covering scientific and engineering fields. That is one of a series on various occupations, to assist in vocational guidance. Only the introductory chapters of this booklet were prepared within the Department, and we are indebted to the appropriate professional groups for all the material in the 16 specialized sections.

I am glad to say that the reception of this booklet has been most favourable and there is a steady demand for additional copies. An interesting sidelight on this series of occupational monographs is the exceptionally heavy request for the French printing. This came partly from the fact that little occupational information was previously available in French. My predecessor, the late Mr. Mitchell, expressed his thanks to the participating societies at the time the booklet was prepared. For my own part, however, I should like to embrace this occasion to add my own word of warm appreciation.

In considering the problem of future supply of engineers there is another aspect to which some of you might wish to give some thought. I am thinking particularly of those engineers who occupy responsible positions in management.

Among the thousands of young men who studied engineering as part of the Veterans Rehabilitation Program, some of the most successful came under the heading of "company undergraduates". These were men who had already established themselves in positions in industry, usually at technician level, before enlisting in the armed forces. On being demobilized they found it possible to supplement their very useful practical experience with a course of theoretical training at one of the universities.

Few if any of them would have taken this step under ordinary circumstances. There must be a great

many similar young men in industry today who have much, or all, of the necessary secondary school education but hesitate to embark on what looks like an expensive and exacting program of university training. To the extent that such cases can be found and given encouragement, there is an untapped source of future engineering talent. I am not suggesting for a moment that you have not already had some success in this regard but may I venture the thought that the way seems open to investigate the matter further within your own spheres.

Roster of Technical Personnel

Now, I should like for a moment to touch on conditions as they are at present. While we endeavour to assure an adequate supply of engineers for the future, we must not fail to make the best possible use now of the engineers we have. One contribution to this end is made by the National Employment Service of the Unemployment Insurance Commission, which maintains five regional offices for Executive and Professional Personnel. These offices exist to find suitable placement for engineers and other highly qualified persons. Technically trained immigrants are included as well as nationals of Canada.

Moreover, we also bear in mind the possibility, which we hope is remote, of a sudden need for a much greater defence effort. In view of this, one of the precautions which we have taken is the revision of the roster of technical personnel in Canada. We have maintained this since it was first established early in the last war. It is a matter of high priority to bring these records up to date, in order that the Government may be able, if need arises, to ensure the fullest utilization of our limited corps of scientists and engineers. Engineers themselves, both corporately and individually, support this view. With their co-operation, therefore, we are going ahead with the project. The objective is to provide the Government with the fullest information on the numbers, ages, fields of specialization, employment distribution and other details which go to make up a complete record.

We find that we can count on replies to our questionnaires from something like two-thirds of each professional group as a result of the first mailing. This is, I believe, a very satisfactory response on a purely voluntary basis. After a suitable interval we are sending out a reminder to those who, for one reason or another, have overlooked the matter. This is improving the coverage, and I express appreciation to you all for your ready co-operation.

Human Factor in Productivity

The engineer is naturally concerned in production. His interest is in the quality and the quantity of the output which can be produced by a limited supply of labour and resources. Much time, energy and money is spent by industry in the study of materials and methods, processes and layout, in the interest of effective operation. Important though these management tools are, they can and should be complemented by a healthy development of the *want to do* attitude by the labour force. Only where this "priceless ingredient" is present can maximum production be achieved, for at the very heart of the matter lie human attitudes.

The importance of good working conditions, fair wages and hours, is now generally recognized by intelligent employers. They realize the value, from a production point of view, of sanitary and well-lighted plants, of care for the health and welfare of the employees, and convenient organization of the work. But beyond that there is the need for partnership and planning to obtain efficiency and high production. The economic security of the worker is obviously important to his peace of mind, which in turn affects his productive capacity. In this field both government and private enterprise can play a part through pension plans and unemployment insurance, and in other ways.

Technology has relieved workers of much heavy, arduous drudgery but it has also reduced the opportunity for creative expression. To reach the heart of the problem of human relations in industry, employers and workers must find a basis for developing mutual respect for the desires and needs of each other. These things are easy to say, but not so easy to do in a large plant. But if a genuinely co-operative atmosphere can be established between labour and management it is evident how greatly production will benefit.

Work of the Department of Labour

The Department of Labour administers various types of machinery for settling industrial disputes, for bringing about better relations between employers and employees, and for increasing generally the economic security of the worker. In the latter connection I need hardly say that the economic security of the employer depends in large measure on the economic security of the worker, involving as it does the ability of the worker to purchase and consume the products of industry.

The Industrial Relations Branch of the Department administers the procedures for appointing Conciliation Officers, Conciliation Boards, Industrial Inquiry Commissioners, and other procedures incidental to the process of collective bargaining in that portion of industry coming within Federal jurisdiction. The Branch also administers Federal fair wage legislation and policy for construction contract work and for the manufacture of supplies entered into on behalf of the Federal Government.

With respect to the 30,000 or more Government employees in industrial classifications, paid on the basis of rates prevailing in private employment, for comparable work, the Branch ascertains the proper rates and recommends them to the various Departments of the Government. The Industrial Relations Branch is also responsible for the encouragement of the operation of Labour-Management Production Committees in industry in accordance with Government policy. These committees were established during the last war to stimulate the increase of productivity by developing a sense of co-operative partnership between labour and management. The Department of Labour has continued to assist and encourage industry to set up these committees. Their number now exceeds 760.

The Industrial Relations and Disputes Investigation Act does not apply to professional engineers and other professional personnel. While the question as to whether such personnel should come under the Act and engage in collective bargaining antedates my tenure of the office of Minister of Labour, I do realize that some engineers have little or no participation in the active management of an enterprise, while others are self-employed or are actively engaged in or identified with management. In these circumstances, it seems to me that your Institute has a unique opportunity to demonstrate to industry generally how apparently conflicting interests can be equitably reconciled.

Your Institute can provide the forum for discussion of problems arising between "employed" engi-

neers and "management" or "self-employed" engineers. We are looking to you to demonstrate how well you have and can get along among yourselves, and, secondly, how such principles of harmony and co-operation can be extended to other industrial groups.

In increasing the economic security of the worker, some of the Government's chief contributions are made through the Unemployment Insurance Commission and the National Employment Service. The number covered by Unemployment Insurance is now not far from three million, and includes about 75 per cent of the paid employees in Canada. The Government's policy is to cover the employees in all industries in which the efficient administration of the scheme is feasible.

The National Employment Service contributes to the economic security of the worker by assisting him to find work of a suitable kind when for any reason he loses his job, or if his present job is unsuitable. Needless to say, there is another face to this medal: the employer is also assisted in finding suitable staff. This service is especially valuable in the present period of conversion to defence production.

Conclusion

I have tried to crystallize some thoughts regarding the part which the Department of Labour and the Engineer, respectively, play in the Canadian economy, and to indicate some of their points of contact. In the effort which now occupies us—to provide adequately for our defence, without too great a disturbance of our civilian economy—there are only certain things which Governments can do directly.

Such important objectives as the increase of production and the maintenance of industrial peace must depend chiefly on the efforts of individuals associated with the labour-management team. Engineers stand in a position to play a vital part on that team, and I am confident that you will do so. ✓

Gasoline Loss Prevention at Edmonton Refinery

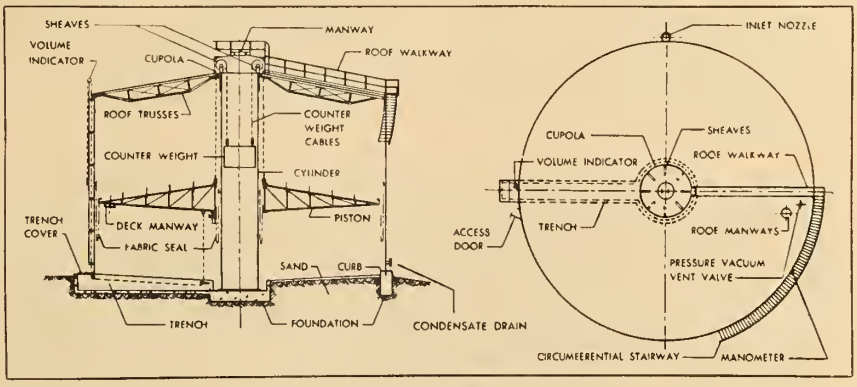
Substantial reduction of evaporation losses will be achieved by the gasholder type vapour saving unit being put into service at the British American Oil Co. refinery at Edmonton, Alberta. Much research has been done on the serious problem of vapour losses. Some 3 per cent of all crude oil has been irretrievably lost—much of it by exhausting to the air vapours from storage tanks, to counteract high pressures due to expansion of the vapours due to temperature changes.

The heart of the installation at Edmonton is a special type of vapour balancing gasholder, a 200,000-cubic-foot capacity Wiggins "dryseal" gasholder 74 ft. 6 in. in diameter and 48 ft. high, designed to the patents of John H. Wiggins, Chicago, expert in oil conservation.

Connected to some 25 large vertical storage tanks of a total capacity of some 300,000 bbls. by gas-tight vapour pipe lines, the gasholder balances the cycles of vapour expansion and contraction constantly occurring in the tanks. In operation, the mixture of air and petroleum vapours forced from the tanks by heat expansion, or by "in-pumping", flows from the tanks at relatively low pressure to the gasholder. Reverse flow takes place when the vapours contract on cooling, say at night or during "out-pumping".

The gasholder may be described very simply as a cylindrical cone-roofed light walled "tank" inside which a steel disc moves vertically to accommodate the constantly varying volumes of vapour from the storage tanks. The steel disc, known as the "piston", is so delicately counterbalanced that it will move up and down within the gasholder shell at very low pressure differentials, equivalent to a fraction of an inch of water.

The piston is somewhat smaller than the gasholder shell, and the annular space in between is closed off by a flexible seal. Vapours are stored below the piston and condensate is drained to a sump and drawn off. The upper shell and roof form merely a weather protection.



Gasholder

Using an arbitrary figure of $6.30 per bbl. cost, it has been estimated that annual savings of some $120,000 may be expected, and that the initial capital outlay will be recovered by the entire vapour balancing system within the first year of operation.

At Lemont, Illinois, the refinery experienced actual savings of many times the theoretical. This may be partly explained by the fact that theoretical calculations cannot include "unaccountable savings" due to considerable vapour displacements in blending and pumping and other similar factors. It shows that substantial vapour savings are certain and capital outlay is rapidly recoverable.

Circuit Breaker Testing

by

W. H. Dickens, M.E.I.C.

Winnipeg District Manager,
Bepco Canada Limited

A paper presented before the Winnipeg Branch of The Engineering Institute of Canada. April, 1951.

The most important, also the most arduous function of the power circuit breaker, is the safe and rapid interruption of short circuits on power systems. Failure to perform this function may have extremely serious consequences.

(1) The failure will necessitate the operation of any other breakers which are feeding the short circuit via the faulty breaker. Thus, an entire distribution system may be shut down.

(2) The failure may result in the temporary loss of a large source of power, thus throwing what may be an impossible load upon the remainder of the power system, with consequent load-shedding and inconvenience in many areas, not directly affected by the failure.

(3) The continued flow of short circuit current, with its associated thermal and magnetic effects, may cause serious damage to the equipment which the breaker is intended to protect, necessitating extensive and costly repairs.

(4) The circuit breaker itself may be damaged beyond repair. Serious arcing or an explosion may develop, with the attendant risk of damage to adjacent apparatus and possible injury or even loss of life.

(5) The interruption in service may be prolonged, which in some cases is very serious. Many industrial processes depend upon the continuity of the supply. Serious financial loss may be sustained from prolonged interruption.

A circuit breaker may fail for one of many reasons, not directly associated with either its design or its inherent interrupting capacity. Unusual service conditions may be one cause. For example, prolonged exposure to damaging fumes or vapours, dust, or excessive moisture will have a deleterious effect on performance. Unusual duties, such as frequent operation, also have their effect. Furthermore, the circuit breaker is frequently called upon to share an excessively high portion of the burden of circuit protection. For example, where systems lack adequate protection against lightning, the same stroke of lightning which produces the short circuit, may cause the failure of the circuit breaker insulation, thus rendering circuit interruption impossible. Another cause of circuit breaker failure is inadequate maintenance. Reliable operation, therefore, depends to a large extent upon the user, firstly, in the correct choice and proper application of a breaker and, secondly, in the administration of regular and adequate maintenance.

With the designer and manufacturer rests the responsibility for a manufacturing, inspecting and testing procedure, so stringent that failure due to faulty design or workmanship is remote. With most engineering products, lengthy operation and experience in the field is by far the best proof of the product's reliability. Field experience usually shows exactly where the product is weak and allows the designer to correct the trouble.

But so far as the fundamentals of interrupting capacity are concerned, the circuit breaker designer has little to learn from field experience, because the forces involved are of a transient and destruc-

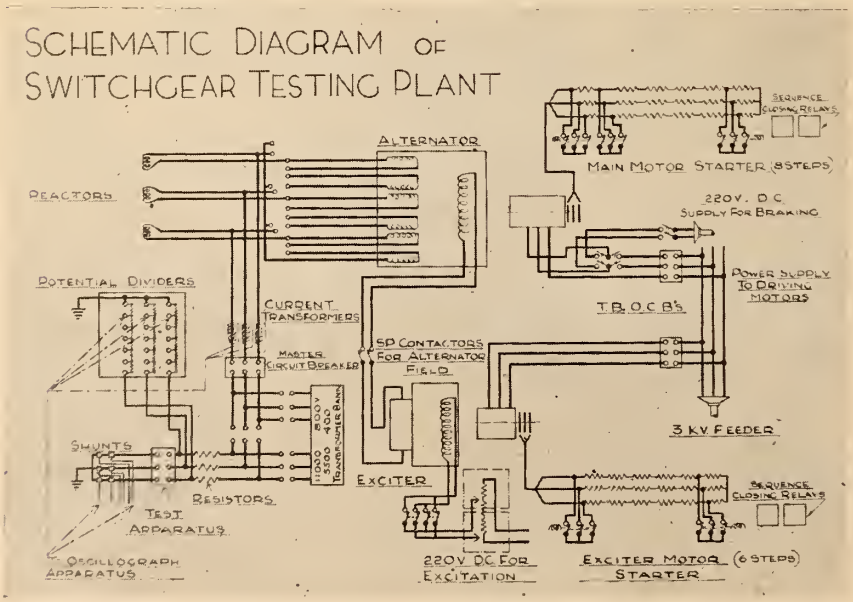


Fig. 1. Schematic diagram of a typical testing station.

The establishment of a high voltage testing plant in Canada has been widely discussed in recent years. Currently a strong committee of the Canadian Electrical Association is considering ways and means of furthering such a project. This paper is therefore timely and of wide interest since the author describes a testing plant which has some special features.

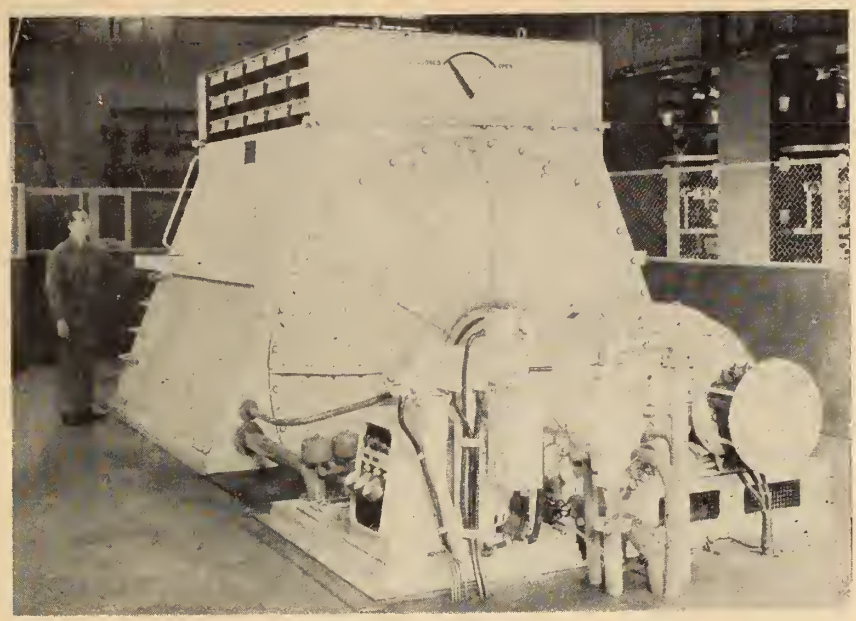


Fig. 2. Generator.

ive nature. If a breaker fails, all hat is usually proven is that the breaker is inadequate for the location. Conversely, satisfactory operation over an extended period is not proof of adequacy. This further emphasizes the need for stringent testing.

Objects of Specifications

The definition and enforcement of an adequate testing procedure is the object of the various national and international specifications dealing with the subject of short circuit testing. While these specifications differ in detail, they all have a common object, namely:

1) To establish conditions of test which are as severe, or more severe than any conditions met in service.
2) To set up definitions and procedure with the object of assuring uniformity of test severity and of interpretation of results.
3) Since short circuit testing can not be carried out on every circuit breaker produced (it must be confined to testing a *type* of breaker), the various specifications set up standards for the routine testing of each circuit breaker produced, to assure that each is the equivalent of its tested prototype.

This last condition is very important and one which is difficult to ensure. Inevitably, much must depend on the production and inspection procedure of the individual manufacturer. Careful production is the most important factor, since the most elaborate inspection and testing procedure cannot uncover every error in manufacture.

The designer, then, in addition to producing a breaker which will interrupt its assigned short circuit current, must be able to produce a design which is neither so elaborate, nor so critical in adjustment, that its production and inspection become too costly. This, of course, is a basic tenet of any engineering production. The designer must strike a nice balance between performance and production costs, bearing in mind that the article he produces may lack adequate maintenance and care.

But because the science of circuit interruption is still largely experimental, any change in design must be accompanied by full scale short circuit testing. Thus, the conclusion is reached that the design of a successful circuit breaker should be accompanied by repeated short circuit testing, during the development stages, and before the certification of the finished circuit breaker is even attempted.

Facilities

The first short circuit tests were carried out on actual power systems. Sometimes this is still necessary, when testing equipment is not available or when the rating of the breaker to be tested exceeds the rating of available testing equipment. Testing of this nature is not particularly satisfactory. Firstly, it usually proves only that the breaker is satisfactory for the location in which it is tested, because the various elements of severity are not all at a maximum in any one particular location.

Testing of this nature may disrupt the operation of the supply company's system and endanger apparatus. The system can usually

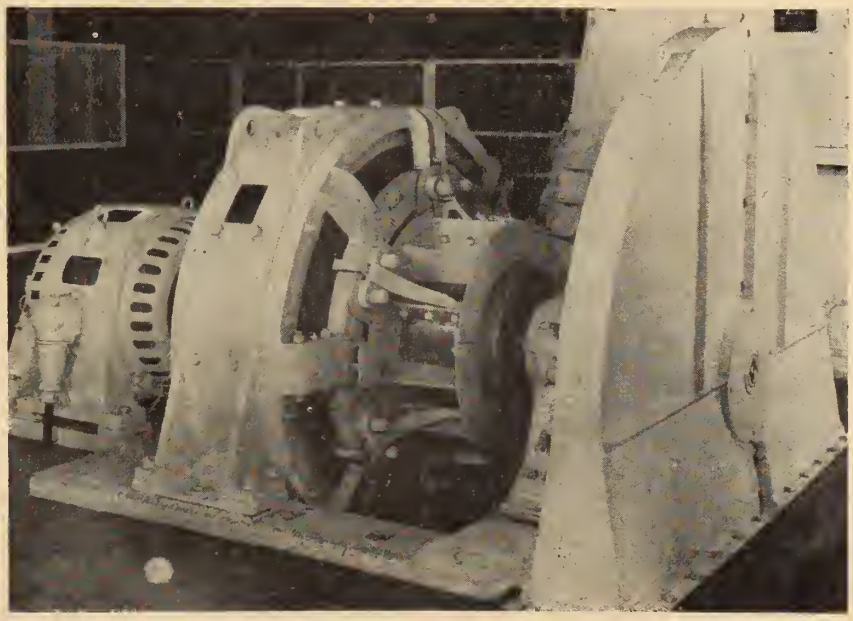


Fig. 3. Exciter set.

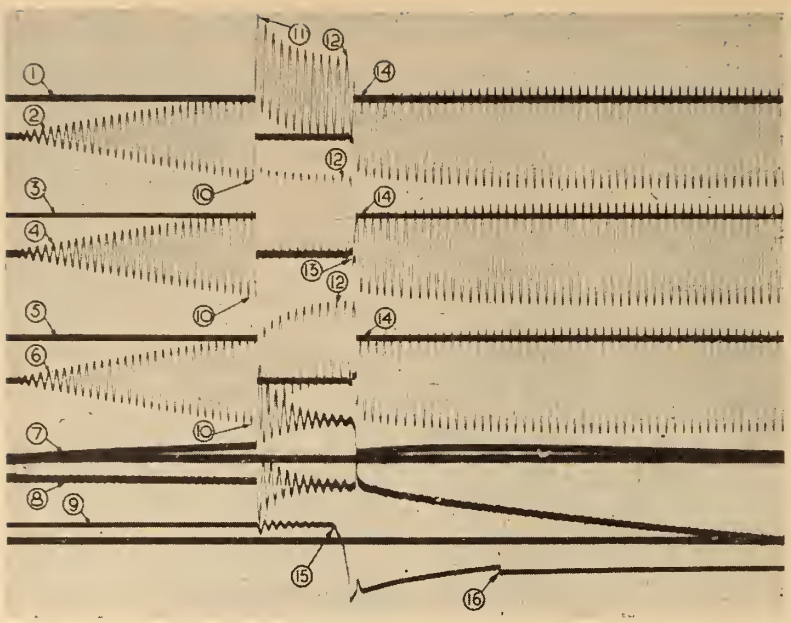


Fig. 4. Make-break test on station master circuit-breaker, illustrating the machine characteristics during test.

Breaking capacity at 11 kv.—382 mva.

1. R-Phase Current Zero Line.
2. R-Phase Voltage.
3. Y-Phase Current Zero Line.
4. Y-Phase Voltage.
5. B-Phase Current Zero Line.
6. B-Phase Voltage.
7. Alternator Rotor Current.
8. Exciter Terminal Voltage.
9. Exciter Field Voltage.
10. Applied Test Voltage: Per Phase—6.35 kv., between Phase—11.0 kv.
11. Peak Making Current—61.0 ka.
12. R.M.S. Breaking Current—20.0 ka.
13. Arcing Voltage.
14. Recovery Voltage: per Phase—6.0 kv. Between Phase —10.4 kv.
15. Point of Tripping Exciter Field.
16. Point of Reversing Exciter Field

be made available for only limited periods. Thus, if some minor mechanical defect develops in the circuit breaker, it is usually necessary to postpone the tests, perhaps for months, until the system again becomes available. The supply company cannot be expected to make the system available for experimental testing, such as is required in the design stages. Recognition of the need both for the proving of breaker ratings and for research facilities for the development of design, resulted in leading manufacturers establishing short circuit testing stations at heavy expense.

Testing Station Requirements

The basic requirements of a testing station are relatively simple. Fig. 1 shows the schematic diagram of a typical testing station. The principal components are:

(1) A generator of sufficient capacity to provide short circuit currents for periods up to maximum for which the installation is designed.

(2) An exciter of sufficient capacity to provide the maximum test voltage for which the generator is designed, and to provide values of recovery voltage, after circuit interruption, within prescribed limits.

(3) Reactors and the resistors for limiting the value of the output from the generator, to enable tests, at ratings below the maximum rating of the generator, to be made.

(4) A station circuit breaker to act as back-up protection for the test generator in the event of failure of the test apparatus.

(5) A transformer bank for tests at voltages other than those obtained by direct generation.

(6) Apparatus to control the sequence of operation of the equipment.

(7) Measuring and recording equipment.

Typical Testing Station

The testing station described in the following was installed by Crompton Parkinson Ltd., at Chelmsford, England, in 1939. It was specially designed to deal with the medium capacity range of switchgear, and in addition offers the fullest possible facilities for the investigation of the effects of the flow of short circuit current in any apparatus. The machines have been designed to act efficiently within the medium capacity ranges, and have a maximum *symmetrical* output of 400 mva.

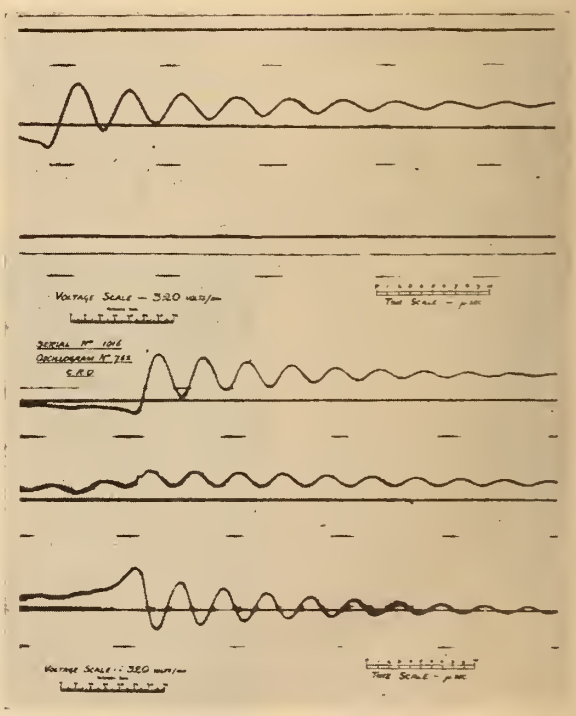


Fig. 5. Cathode Ray Oscillogram No. 762.

Restriking Voltage Peak—9.2 kv.
Rate of Rise of Restriking Voltage—8.50 volts/micro-second.
Natural Frequency of Primary Transient—20,000 cycles/second.
Natural Frequency of Secondary Transient—24,000 cycles/second.
Mean Recovery Voltage (as recorded by electromagnetic oscillograph) Per Phase—3.1 kv, between Phase—5.4 kv.

The machines have the necessary thermal rating for this output for two seconds. This comparatively long thermal rating permits certain test duties, comprising a number of shots at close intervals (as short as 15 seconds), to be undertaken without adverse heating characteristics. Where test requirements are such that use can be made of the total R.M.S. current available in the first few cycles of current, the rating of the station is appreciably higher. It can then be considered to be a maximum of 650 mva.

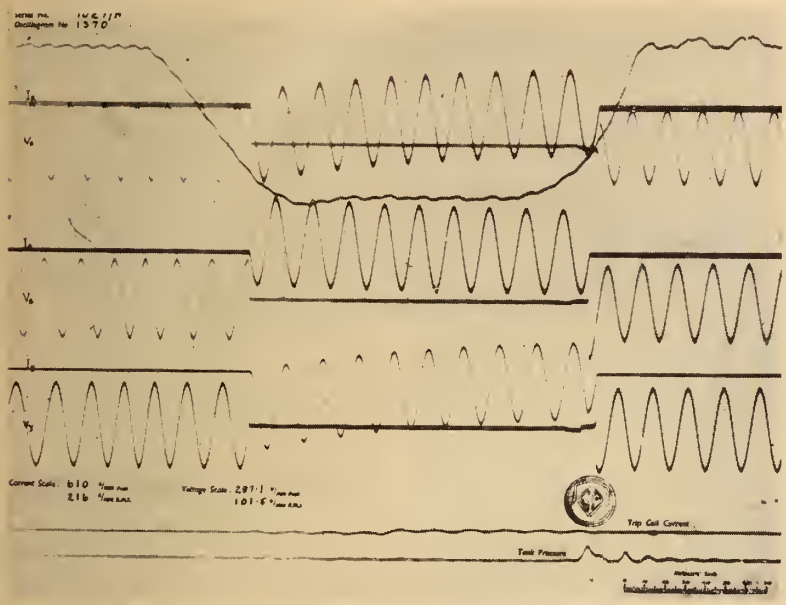


Fig. 6. Typical high voltage M.B. operation on oil circuit-breaker.

The Generator

The generator (Fig. 2), incorporates electrical and mechanical features, enabling the machines to deliver the high output required for modern short-circuit testing, and to safely withstand the severe stresses. The alternator is ventilated without external fans or other cooling means. For lubrication, oil under pressure is continuously forced through the bearings and is drained to a 400 gallon sump, then pumped through a cooler to a gravity tank. To decrease the starting torque, independent pneumatically operated high pressure pumps supply an oil stream to each bearing during the starting period. The alternator is driven by a 3-phase slip-ring induction motor, continuously rated at 675 hp. and capable of accelerating the rotor to the full speed of 2,950 r.p.m. in six minutes.

The motor starter, of the contactor type, is arranged for automatic acceleration. The contactors close in successive steps when the current falls to a predetermined value. To limit the power consumed during a test, these contactors open, leaving the machine running with all resistance in the rotor circuit. The flywheel effect is sufficient to maintain the speed, and at the end of the short-circuit period the contactors close, restoring full speed automatically.

Excitation Set

The exciter (Fig. 3) has an output of 4,000 amps. at 1,050 v for two seconds, this output being necessary to maintain the short-circuit current at the full value, and to provide full recovery voltage at the end of the short-circuit period. Most modern testing stations employ some means of super-excitation, the excitation current being increased during the short circuit period to counteract the effects of armature reaction. Super-excitation is here obtained by the use of the time constants of the circuit.

The exciter driving motor control circuit is arranged similarly to that of the test generator, to prevent disturbances to the supply system. A flywheel maintains the speed of the set during the short-circuit period. Relays are installed to open the excitation circuits after a pre-determined time, normally 1-second for breaker tests, thereby limiting damage due to failure of the master circuit-breaker. The open-circuit terminal voltage of the alternator is dependent upon the excitation circuit time constant. During short-circuit, considerable surges are induced in the rotor by virtue of the initially high values of the d-c component contained in the low-power-factor fault currents.

Machine Room Switchboard

The machine-room switchboard has two oil circuit-breaker panels, with protective relays controlling the supply to the motors. Additional panels accommodate instruments, relays, temperature recording apparatus and other switching functions, while at the rear are the contactors. The main contactors of the alternator field system are pneumatically operated. The control of the excitation current is by motor-operated rheostats actuated from the control room.

Reactors

Eight 3-phase sets of air-cored reactors, which can be switched in

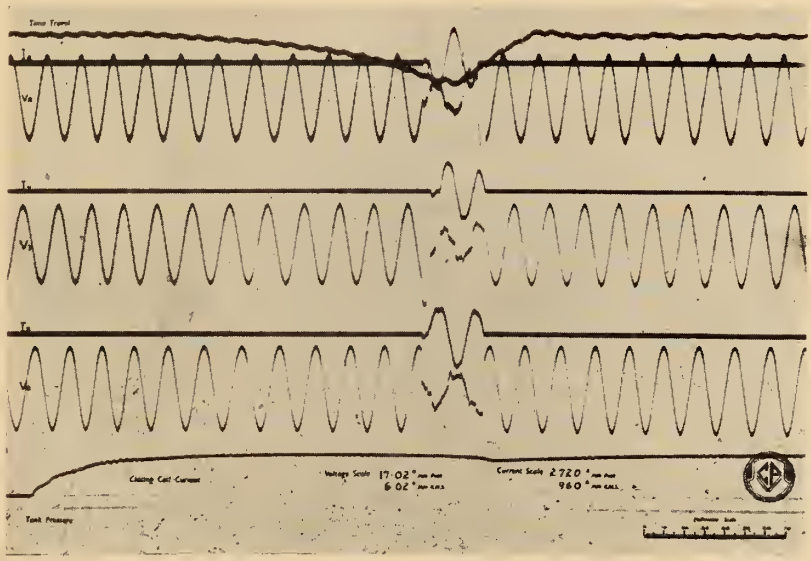


Fig. 7. Typical M.B. operation on low-voltage O.C.B. fitted with force-tripping, operated by C.Ts.

series and parallel combinations, provide the means for a range output of from 2.5 mva to the full rating of the machine within limits, at any selected current value, and at the lowest power factors, of + 7 per cent. The reactor switching arrangement has a device that enables the control room engineer to indicate the desired connection, which operation, when complete, is automatically signalled back to the control room.

The compact layout of the testing plant minimizes both the capacitance-to ground and resistance of the circuits, thereby providing the highest possible inherent natural frequency and consequent severity of the restriking voltage immediately after arc extinction. Resonant frequencies have been recorded up to 210,000 cycles per second. A comprehensive survey has been made of the inherent restriking voltage characteristics for all test circuits, with a wide range of reactor and machine settings, covering the standard short-circuit capacity ratings. At least two transients of different severities are possible for each rating. Alternative grouping of the eight reactors provide further variations in severity for a particular rating.

The connections are taken from the reactors through current transformer bushings to the master circuit breaker. The master circuit breaker serves each of the two test cells and the outdoor test area, either direct or through low voltage transformers. The bank of three single-phase transformers has an output of 112,000 amps. at 400 v., and provides facilities for making and breaking capacity tests on low-voltage circuit-breakers, contactors and fuses, short-time current rating tests and the investigation of the effects of short-circuit thermal and mechanical stresses on equipment, including power transformers, current transformers, reactors, cables and busbars.

Each transformer has two windings on each primary and secondary coil, connected in series or parallel to provide outputs at 800 volts (also suitable for the 600 to 660 v range), 400 to 440 v or 230 to 250 v. By appropriate timing of the excitation, a constant output up to the highest value is achieved, without decrement, for a period of five seconds.

The making switch, designed for maximum current on low-voltage tests, may be inserted between the high-power supply and the test apparatus, which in the test cell is grounded through current-measuring shunts of the appropriate range. In addition to its main function, this unit is used to delay the initiation of the short-circuit to some controlled instant on the waveform, when the transformer core flux has assumed a steady value. The purpose of this is to eliminate undesirable harmonics in the voltage waveform.

Test Cells and Outdoor Test Area

Test cells are located outdoors, at a safe distance from the control and observation room. The larger test cell will accommodate the largest piece of apparatus likely to be encountered. The smaller test cell is used for apparatus rated up to 150 mva. A spacious test area is provided for testing equipments intended for use outdoors. Provision is made on panels mounted in both test cells for the connections to all measuring circuits. A compressed air supply is available ranging up to 180 lbs. per sq. in., higher pressures being obtained from a portable unit.

Fire protection is provided by atomized-water spray equipment actuated by an electro-magnetic valve in the control room. The water supply is maintained at a constant pressure of 100 lbs. per sq. inch. A similar system, thermally operated, protects the transformers and master circuit-breaker.

Control Room

The control and recording equipment, situated in the control room in a separate building, is arranged to facilitate rapid operation of the plant. All control and signal switches are contained in a convenient layout, together with the master sequence controller which initiates the various switching operations.

The master controller incorporates twelve rings on a common shaft, motor driven through a reduction gear. Switch-strikers, on the periphery of each ring are adjustable in position. By means of a stepped pulley, tests of varying durations up to 25 seconds may be governed by the master controller.

The leads from the shunts, current transformers and other recording units are taken to the reconnection table, where each circuit may be calibrated by the insertion of standard instruments, before continuing to the oscillographs. In the fully-equipped dark room, adjacent to the control room, the oscillographic records are developed and examined, normally within two minutes after taking.

Recording Plant

The electro-magnetic oscillograph incorporates twelve elements of various types to record simultaneously traces of voltages, current, arc powers, crossbar travel, fluid pressure or forces in mechanism links. In addition, a timing device records, at each edge of the recording paper or film, marks at one-hundredth of a second intervals. A continuous type camera has a removable container for the exposed record. The time base for the oscillogram is provided by the movement of the film. Using an adjustable speed motor, perfectly uniform motion of record is accomplished at speeds from one inch to 175 inches per second.

The cathode-ray oscillograph was specially developed for use in the testing station to cover a wide range of duties. For routine testing this three-element oscillograph records the restriking frequency at which the voltage recovers after the extinction of the power arc. While the normal working range of the oscillograph is up to 300 kc/sec. a one megacycle wave has been recorded. As with the electro-magnetic oscillograph, circuit-breaker and fuse records may be examined within two minutes.

Typical Oscillograms of Tests

Figure 5 shows a record of restriking voltage, following arc extinction in a 3 phase circuit breaker produced by the cathode-ray oscillograph. The upper of the two sections of the oscillogram shows the restriking voltage occurring in the first phase to clear. The lower section of the oscillograms shows the subsequent restriking voltage transient in the remaining two phases, and the consequent disturbance in the first phase to clear.

Figure 6 shows a typical make-break test on an oil circuit breaker, the break being made only after the d.c. component of short circuit current has decreased to a comparatively negligible value. Figure 7 shows a make-break test on an oil circuit breaker fitted with current transformer operated or series trip coils. In this case, the breaker commences to trip as soon as the contacts touch. This results in the reduction of the

(Continued on page 27)

SMALL PIPE SYSTEM *for* WARM AIR HEATING

A reprint of Research Bulletin No. 101, published by Queen's University.

by

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In recent years with the rising cost of construction, the trend has been to small, compact houses. These houses are generally well insulated, and have fairly small rooms. Since all the rooms are approximately the same size and hence have approximately the same heat loss, it seemed possible that a simpler heating system could be designed with uniform duct work and fittings throughout. This would avoid the present high cost, custom-made fittings.

In an attempt to provide this cheaper heating system without sacrificing comfort, some installers are trying warm-air systems using round pipe of various diameters as supply ducts. Varying results are being reported from the owners of such systems already installed. This investigation was therefore started to supply some design information for these so-called small pipe systems. The principal part of the investigation covers the resistance values of various plenum take-offs as well as registers and register boxes.

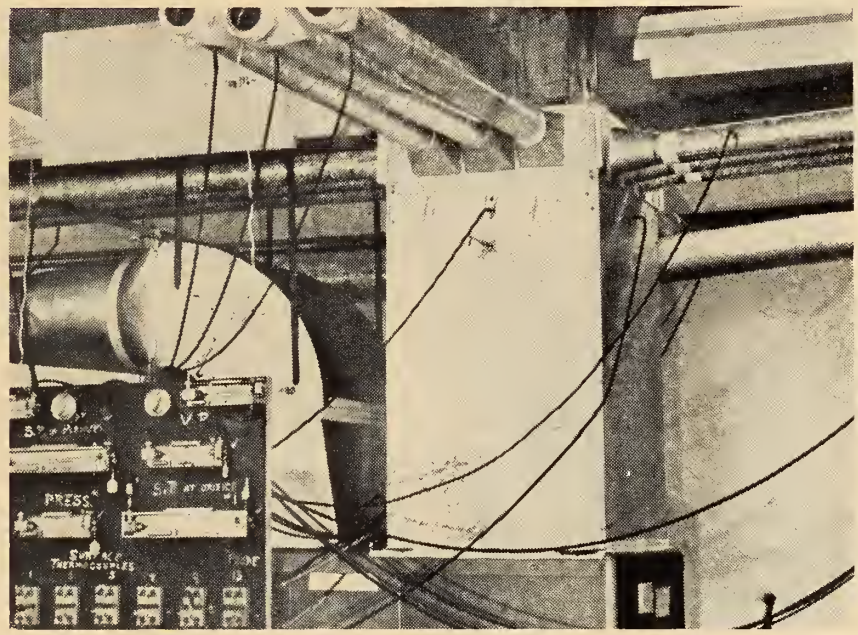


Fig. 2 - 1

Test Set-up

A conventional packaged forced-air furnace was used for this work. A square plenum was set on the warm-air opening and twelve take-offs fitted on the plenum, three on each side. Four feet of 4″ pipe was connected to each take-off. (Fig. 2-1.)

An orifice, calibrated in position in the end of each pipe, was used to measure the air flow. The total flow through the furnace was measured by means of a pitot tube in a venturi section on the inlet side. Twelve take-offs (Fig. 2-2) were installed on the plenum at the start, in order to investigate the flow distribution and

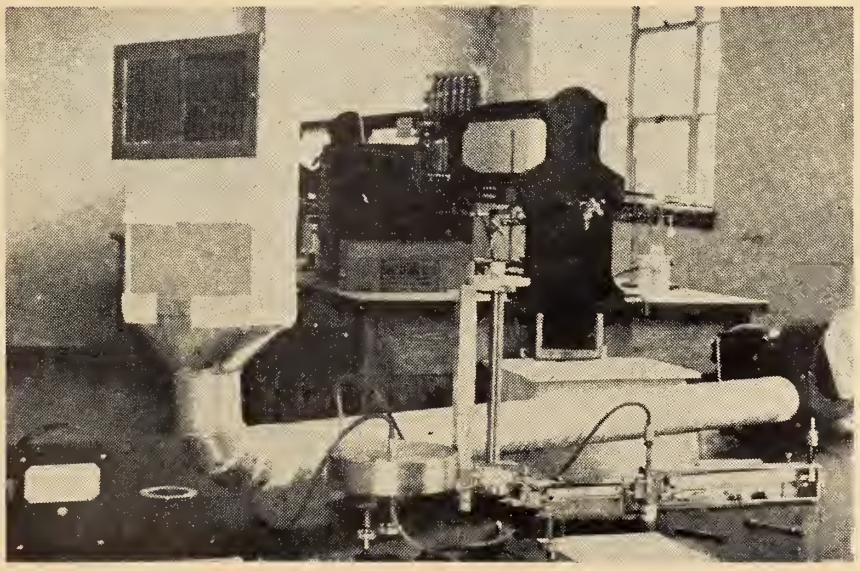


Fig. 2 - 7

Fig. 2 - 4

Fig. 2 - 2

Fig. 2 - 3

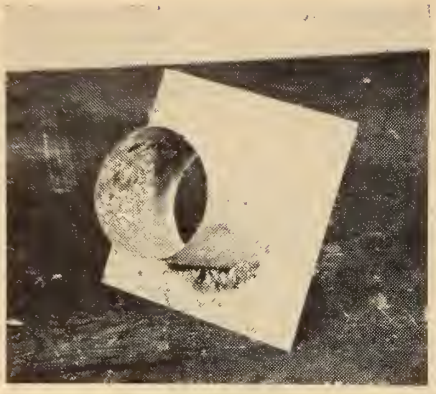


Fig. 2 - 6

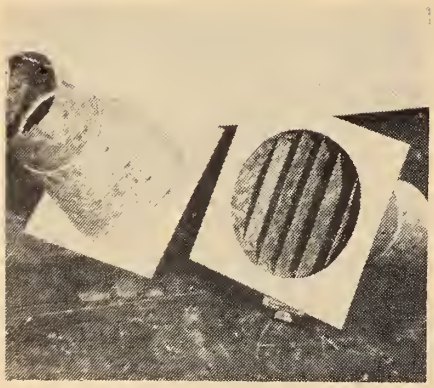


Fig. 2 - 5

the temperature distribution in the twelve ducts.

A baffle (Fig. 2-3) was used to mix the air and give a uniform temperature across the plenum, and hence an equal temperature in each supply pipe. The opening in the top of this baffle was made between 20 and 30 per cent greater than the combined areas of the warm air pipes. The bottom of the baffle was fitted over the warm-air opening of the furnace at the base of the plenum chamber. The sides of the baffle slope in at about 45 deg. There were four different types of take-offs tested. (Figs. 2-2, 2-4, 2-5, 2-6.) The effect of blocking off certain take-offs was also investigated to determine how the flow in the other ducts would be affected.

Fig. 2-7 shows the arrangement of apparatus for the register tests. A 4-foot length of 4″ pipe was connected to the outlet of a small fan and the 90 deg. elbow and register box were then connected to the pipe. The air delivery was varied by adjusting a damper on the inlet of the fan. The static pressure was measured by a micromanometer and the total pressure was measured by an inclined draft gauge. The total pressure readings were calibrated against an orifice meter before the test in order to obtain the volume of air flowing through the register. The tests consisted of trying different lengths of register boxes and different deflections of the air coming out of the register.

Results of Investigation

Figure 3-1 shows the resistances of the various take-offs. The cone with the fins (Fig. 2-5) is the best take-off, although the cone and the square are both acceptable. The flush butt take-off is not recommended.

In the tests on distribution the plenum was fitted with twelve of the square take-offs. It was found that the volume of air and the temperature of the air were practically uniform over all the take-offs. This even flow and temperature distribution were attributed to the baffle shown in Fig. 2-3. When different outlets were blocked off the uniformity of flow was not affected.

Fig. 3-2 shows the different arrangements investigated and their

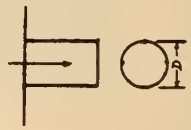
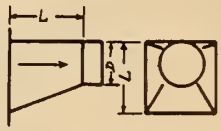
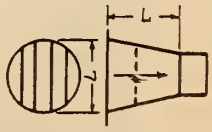
FITTING	ILLUSTRATION	CONDITIONS	VEL. HEAD LOSS
FLUSH BUTT TAKE-OFF		L = 6″ D = 4″	0·69 V.P.
SQUARE TAKE-OFF		L = 6″ D = 4″	0·19 V.P.
CONE TAKE-OFF		L = 6″ D = 4″	0·21 V.P.
CONE TAKE-OFF WITH FINS		L = 6″ D = 4″	0·14 V.P.

Fig. 3 - 1

dentifying numbers. Fig. 3-3 gives the resistance of these various arrangements plotted against C.F.M. of air delivered. From the graph in Fig. 3-3 it is seen that the register boxes with the longer stack sections give lower resistances. The longer section of stack allows the air to spread out and lose some of its velocity before reaching the register.

As a result, there is a more even velocity distribution over the register face, eliminating high velocity spots which cause high resistance. It is therefore recommended that a register box similar to No. 3 or 4 be used, which puts the register from 6 inches to 1 foot above the baseboard in an actual installation.

A more preferable arrangement would be the use of a long transition piece in place of the short transition and stack section. The transition piece would be 20″ and 14″ long for No. 3 and No. 4 respectively.

Design Considerations

If a limiting velocity of 700 FPM in the 4″ pipe and a register temperature of 155 degree F. are selected, the following calculations determine the capacity of one pipe:

Air volume

$$=700\times A$$
$$=\frac{700\times 3.14\times 16}{4\times 144}=61.1 \text{ CFM}$$

Air density

$$=\frac{1.327\times \text{BAROMETER ("Hg)}}{\text{Abs. Temp.}}$$
$$=\frac{1.327\times 30}{615}=0.0646 \text{ lbs./cu.ft.}$$

BTU delivery

$$=61.1\times 0.0646\times 60\times 0.24\times 90$$
$$=5130 \text{ BTU/hr.}$$

where A = area of 4″ pipe:
BAROMETER ("Hg) = 30″ (assumed)
ABSOLUTE TEMP. = 460 + TEMP. (Deg. F.)
0.24 = SPECIFIC HEAT OF AIR (BTU/lb/deg.F.)
90 = TEMP. RISE FROM 65 deg. F. to 155 deg. F.

As an average figure we can see that each pipe is capable of delivering 5000 B.T.U./hr.

The type of house that is suited to this type of heating now appears to be:

(1) All the rooms must have a heat loss of 5000 BTU/hr. or less, with the exception of one or two rooms, possibly the living room where two or more outlets may be installed.

(2) Since the resistance of a 4″ pipe is fairly high the house should be fairly compact, avoiding any extremely long runs.

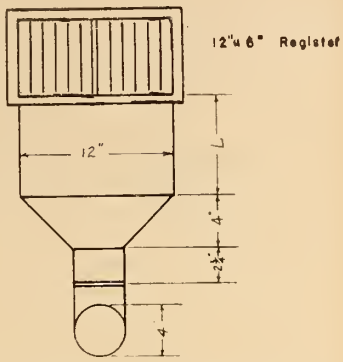
Fig. 4-1 shows the various fittings used in the small pipe system, with their equivalent lengths. The total equivalent length of any warm air run should not exceed 80 feet including register and register box. This equivalent length gives a static pressure in the plenum of the furnace of 0.2″ W.G.

The return air system is designed and sized in the conventional way. The sizes are based on Manual No. 7 of the National Warm Air Heating and Air Conditioning Association.

General Steps in Design of the System

(a) Calculate the heat loss of each room in the house. (Manual No. 3 of the N.W.A.H. & A.C.A.)

(b) Select a furnace with a register delivery equal to or greater than the sum of the heat losses calculated in (a).



ARRANGEMENT NO	CONDITIONS	VEL HEAD LOSS
1	L = 4" DEFLECTION 35°	3 28 V P
2	L = 4" DEFLECTION 0°	3 25 V P
3	L = 16" DEFLECTION 0°	2 91 V P
4	L = 10" DEFLECTION 0°	2 96 V P

Fig. 3 - 2

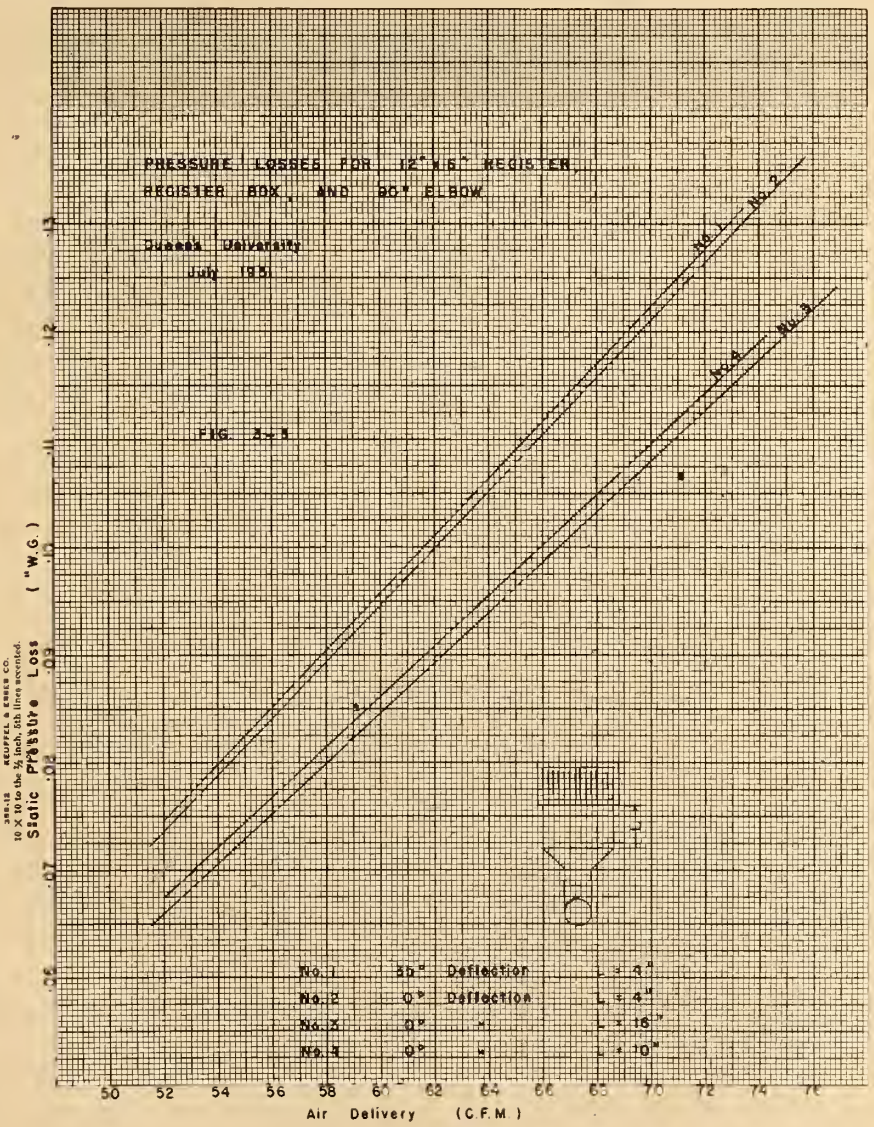


Fig. 3 - 3

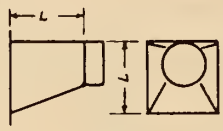
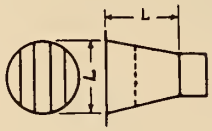
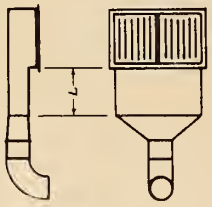
FITTING	ILLUSTRATION	CONDITIONS	EQ. FT. OF 4" DUCT
Round – Radius Elbow		$R/D = 0.75$	5
45° Elbow		$R/D = 0.75$	2 1/2
Square Take-off		L = 6"	3
Cone Take-off		L = 6" D = 4"	3
Cone Take-off with fins		L = 6"	2
Register and Box		12 x 6 Register 12 x 3 1/2 Stock L = 10 to 16 inches Elbow included in Equivalent Length	35

Fig. 4 - 1

(c) Locate registers:
(1) Common practice is to install warm-air registers so that the warm air covers or blankets a cold-wall.
(2) A good location for the warm-air register is in an inside partition, in the low wall location, and directing the warm air along an outside wall.
(3) With this type of small pipe system, since the average register velocity is low, the high wall location is not as satisfactory in general, and should be used only if the low wall location interferes with furniture placement.
(4) In general the location of the cold air return grille does not appreciably affect temperature conditions in the room.
(5) Special attention should be given to the natural circulation in the room and the return air grilles located accordingly.
(6) Returns should not be placed in bathrooms, kitchens, garages and storage spaces.

(d) Run 4″ pipes from the furnace to the warm-air registers attempting to keep the resistance low. Check the total equivalent length that it does not exceed 80 feet. Total equivalent length equals the equivalent length of fittings and register plus the actual length of pipe both horizontal and vertical.

(e) Size the return-air system according to Manual No. 7.

(f) Equip all return lines and warm-air pipes with dampers to regulate the air flow.

(g) Balance the system for Continuous Air Circulation.
(See Manual No. 6 N.W.A.H. & A.C.A.). √

The Heat Pump

During the last war the German Navy made use of heat pumps to heat their submarines. A heat pump is in effect a refrigerator operating in reverse. Buildings such as houses can be successfully heated by means of heat pumps.

This is done by locating the heating unit corresponding to the refrigerator condenser in the building to be heated and placing the cooling elements outside. In the case of the submarines the cooling elements were of course located on the outside of the hull and cooled the surrounding ocean.

One of these "submarine" heat pumps, brought to Canada by a team of scientists who toured Germany in 1945, was adapted to use with ground coils by the Division of Building Research of the National Research Council. The Division has installed this unit in sandy soil at Ottawa. Soil moisture meters are included among the instruments. Soil analyses and an extensive series of temperature measurements are being made.

This investigation is aimed at a better understanding of two things: first, the mechanics of heat and moisture flow in the ground, and, second, the transfer of heat to ground coils.

Slow Braking of Mine Hoists

by

L. O. Cooper, M.E.I.C.

Schumacher, Ont.

On modern hoists, the brakes are generally applied automatically in case of overwind, overspeed, or power interruption. The safety dogs on the hoisting conveyance are normally operated by a spring, which comes into action when the tension between rope and conveyance drops below some pre-determined limit. It is quite possible therefore, in the case of a sudden stop, for the dogs to set.

If, for example, the spring tension was set at ⅓ the weight of the cage, then the maximum deflection from neutral position during oscillation (with an empty cage) should not be allowed to exceed ⅔ of the static deflection due to the cage. It is apparent that certain limits must be imposed on the rate of emergency brake application, if accidental dogging is to be avoided. It is the purpose of this paper to determine the limits.

It is first necessary to determine the maximum deflection of the conveyance from neutral position, under the different stopping conditions that might arise in practice. In doing this it will be assumed that when the brakes are applied, the braking torque is proportional to time, until the hoist has been brought to rest.

It has been found that this closely approximates actual conditions. Downward directions will be considered as positive and the following symbols will be used:—

u = Initial cage velocity—feet per sec.
t = Time in seconds measured from the start of deceleration.
At = Deceleration of top end of rope—feet per sec. per sec.
x = Length of suspended rope in feet at time $t = t$
x_o = Length of suspended rope at time $t = o$.
k_x = Rope spring constant or load in lbs. required to produce a deflection of 1 foot in the rope with rope length $= x$.
w = Weight of rope in lbs. per ft.
W_c = Weight of cage — lbs.
W_L = Weight of cage load — lbs.
W = Weight of cage plus wt. of load.
g = Gravity constant.
v = Velocity of cage at time t — feet per sec.

At time $t = t$, with x feet of rope out, the extension of the rope above the static extension would be equal to $x - x_o - \left(ut - \frac{At^3}{6}\right)$. This is because the amount of rope let out after applying the deceleration would be equal to $ut - \frac{At^3}{6}$. Part of this extension would be due to decelerating the rope, and part due to decelerating the load. To determine the extension due to decelerating the rope, consider an elemental length of rope, dy, at a distance y from the top. Then the force required to decelerate the element $= \frac{w}{g} . dy\left(a - \frac{y}{x}(a-b)\right)$

where $-a$ = deceleration of top end of rope
and b = deceleration of bottom end of rope

The extension due to deceleration of element =

$$\frac{\frac{w}{g} . dy\left((a - \frac{y}{x}(a-b)\right)}{k_y}$$

But $k_y = k_x . \frac{x}{y}$

Therefore rope extension due to deceleration of element =

$$\frac{w}{g} . dy\left(a - \frac{y}{x}(a-b)\right) . \frac{y}{k_x . x}$$

$$= \frac{w}{k_x . g}\left(a . \frac{y}{x} - \frac{y^2}{x^2}(a-b)\right) dy.$$

Then the total rope extension due to decelerating the rope would be—

$$\frac{w}{k_x . g}\int_{y=o}^{x}\left(\frac{a . y}{x} - \frac{y^2}{x^2}(a-b)\right) dy$$

$$= \frac{w}{k_x . g}\left[\frac{a\, y^2}{2x} - \frac{y^3}{3x^2}(a-b)\right]_o^x = \frac{w}{k_x . g}\left(\frac{ax}{6} + \frac{bx}{3}\right)$$

Since the rope let out during the period of deceleration is small compared to the total length of rope, we may consider wx to be the weight of rope out at the time deceleration begins, and call this quantity W_R. The total rope extension due to decelerating the rope would then be equal to $\frac{W_R}{k_x . g}\left(\frac{a}{6} + \frac{b}{3}\right)$.

The remaining extension produces the deceleration in the cage and load and we therefore have:

$$\frac{W}{g} . \frac{d^2x}{dt^2} = -k_x\left(x - x_o - (ut - \frac{At^3}{6}\right) - \frac{W_R}{k_x . g}\left(\frac{a}{6} + \frac{b}{3}\right)$$

But $b = -\frac{d^2x}{dt^2}$ and $a = At$

Therefore

$$\frac{W_1}{g} . \frac{d^2x}{dt^2} = -k_x\left(x - x_o - (ut - \frac{At^3}{6}\right) - \frac{W_R . At}{6\, g . k_x}\right)$$

where $W_1 = W + \frac{W_R}{3}$

Differentiating, we get—

$$\frac{W_1}{g} \cdot \frac{d^2v}{dt^2} = -k_x \left(v - u + \frac{At^2}{2} - \frac{W_R . A}{6\, g . k_x} \right)$$

The rope spring constant k_x will change very little during the decelerating period. Thus the constant for the original rope length "x_o" will be used and simply called k.

$$\text{Then } \frac{d^2v}{dt^2} + \frac{k . g}{W_1} . v = \frac{g\ k}{W_1} \left(u - \frac{At^2}{2} + \frac{W_R . A}{6\, g\, k} \right)$$

This is a linear differential equation of the second order, with constant coefficients. The complete solution obtained by usual method is—

$$v = u - \frac{At^2}{2} + \frac{W_R . A}{6\, g\, k} + \frac{A}{n^2} + C_1 \cos. nt + C_2 \sin. nt$$

where C_1 and C_2 are arbitrary constants

and $n^2 = \frac{g\ k}{W_1}$

But when $t = o$, $v = u$

$$\text{Therefore } C_1 = -\left(\frac{W_R . A}{6\, g\, k} + \frac{A}{n^2} \right)$$

$$= -\frac{A}{n^2} \left(1 + \frac{W_R}{6\, W_1} \right)$$

And when $t = o$ $\frac{dv}{dt} = o$

Therefore $C_2 = o$

$$\text{Then } v = u - \frac{At^2}{2} - C_1 (1 - \cos. nt) \ldots\ldots\ldots\ldots (1)$$

From equation 1 we get—

$$v = \frac{dx}{dt} = u - \frac{At^2}{2} - C_1 (1 - \cos. nt)$$

$$\text{Then } x = ut - \frac{At^3}{6} - C_1 t + \frac{C_1}{n} . \sin. nt + C_3 \ldots\ldots (2)$$

Where C_3 is an arbitrary constant.

But when $t = o$, $x = x_o$ Therefore $C_3 = x_o$

The extension above the static extension is equal to

$$x - x_o - \left(ut - \frac{At^3}{6} \right)$$

$$= -C_1 t + \frac{C_1}{n} . \sin. nt \text{ (from equation 2)} . (3)$$

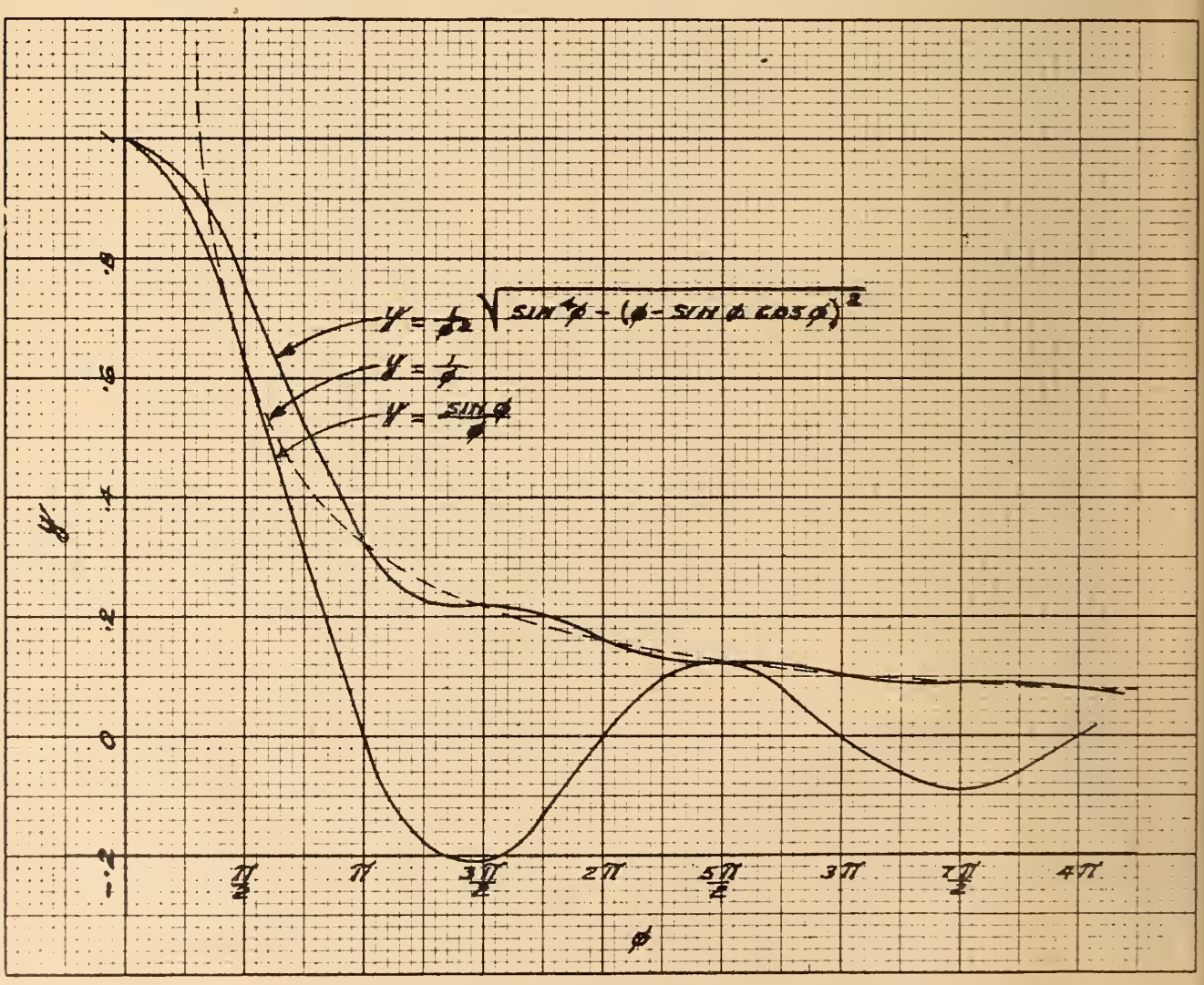


Fig. 1

Thus if we call the time "T" when the hoist drum comes to rest, the cage is then travelling with a velocity of $u - \frac{At^2}{2} - C_1\,(1 - cos.\,nT)$. But $A = \frac{2u}{T^2}$ so the velocity $= -C_1(1 - cos.\,nT)$. The rope extension above the static extension at this time is equal to $-C_1T + \frac{C^1}{n}.\ sin.\,nT$, from equation 3. After this time the motion of the cage will be harmonic, if friction is neglected, and energy equations may be used for further investigation.

If now we let y equal the displacement of the cage from the static position of equilibrium, then

$$\frac{W_1}{2g}\left(\frac{dy}{dt}\right)^2 + \frac{ky^2}{2} = \text{a constant} \ldots\ldots\ldots\ldots\ldots (4)$$

In this energy equation, it has been shown that the weight used should be equal to the suspended load plus ⅓ the weight of the spring (in this case the rope). The symbol W_1 has therefore been used, as it is equal to $W + \frac{W_R}{3}$. In equation (4) the constant will be equal to the total energy at time $t = T$, so we have—

$$\frac{W_1}{2g}\left(\frac{dy}{dt}\right)^2 + \frac{ky^2}{2} = \frac{W_1}{2g}.\ C_1^2\ (1 - cos.\,nT)^2 + \frac{k}{2}.\ C_1^2 \left(T - \frac{1}{n}.\ sin.\,nT\right)^2$$

The extension y will be a maximum when $\frac{dy}{dt} = o$ so—

$$y\ max. = \pm\frac{C_1}{n}\sqrt{(1 - cos.\,nT)^2 + (nT - sin.\,nT)^2}$$

$$= \pm\frac{C_1}{n}\sqrt{4\ sin.^4\frac{nT}{2} + (nT - sin.\,nT)^2}$$

or

$$y\ max. = \pm\frac{A}{n^3}\left(1 + \frac{W_R}{6W_1}\right)\sqrt{4\ sin.^4\frac{nT}{2} + 4\left(\frac{nT}{2} - sin.\frac{nT}{2}\ cos.\frac{nT}{2}\right)^2}$$

$$= \pm\frac{u}{n}\left(1 + \frac{W_R}{6W_1}\right)\frac{1}{\phi^2}\sqrt{sin^4\,\phi + (\phi - sin.\,\phi.\ cos.\,\phi)^2} \ldots\ldots\ldots (5)$$

where $\phi = \frac{nT}{2}$.

If we work out the maximum deflection in the same way when a constant deceleration "a" is applied at the end of the rope, we obtain—

$$y\ max. = \pm\frac{u}{n}\left(1 + \frac{W_R}{6W_1}\right)\frac{sin\,\phi}{\phi} \ldots\ldots\ldots\ldots\ldots (6)$$

In both cases there is a sinusoidal effect given to the maximum deflection curve by the last factor, but the worst condition can be approximated by taking this factor as $\frac{1}{\phi}$. This is shown in Figure 1, where the effect of these factors alone has been plotted. The equation for maximum deflection then reduces to

$$y\ max. = \frac{2u}{n^2T}\left(1 + \frac{W_R}{6W_1}\right)$$

$$= \frac{2u}{T}\,\frac{W_1}{gk}\left(1 + \frac{W_R}{6W_1}\right) \ldots\ldots\ldots (7)$$

If we now let

W_L = weight of load on cage
W_C = Weight of cage
W_R = Weight of rope
S = spring load to hold safety dogs in disengaged position

Then $W_1 = W_L + W_C + \frac{W_R}{3}$

$$\text{Static deflection} = \frac{W_L + W_C + \frac{W_R}{2}}{k} = \frac{W_1 + \frac{W_R}{6}}{k}$$

Deflection required to keep safety dogs in disengaged position =

$$\frac{S + \frac{W_R}{2}}{k}$$

In order to keep the safety dogs from engaging, the static deflection *minus* y max., must be greater than $\frac{S + \frac{W_R}{2}}{k}$

$$\text{or}\quad \frac{W_1 + \frac{W_R}{6}}{k} - \frac{2u}{T}\,\frac{W_1}{gk}\left(1 + \frac{W_R}{6W_1}\right) > \frac{S + \frac{W}{2}}{k}$$

$$\text{or}\quad 1 - \frac{2u}{gT} > \frac{S + \frac{W_R}{2}}{W_L + W_C + \frac{W_R}{2}}$$

$$\text{or}\quad T > \frac{2u}{g}.\ \frac{W_L + W_C + \frac{W_R}{2}}{W_L + W_C - S}$$

The second term in the above expression is a maximum when $W_L = O$ (i.e. with the cage empty) and when $\frac{W_R}{2}$ is a maximum (i.e. with the cage at the greatest depth). The minimum value of "T" must therefore be found for an empty cage at the maximum depth. In this case the expression becomes—

$$T > \frac{2u}{g}.\ \frac{W_C + \frac{W_R}{2}}{W_C - S} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

where T = stopping time of hoist—seconds
u = maximum hoisting speed—feet per sec.
W_C = weight of cage—lbs.
S = safety dog spring tension—lbs.
W_R = maximum weight of rope

As an example of the use of Equation (8), consider an installation where the shaft depth is 3000 ft., the rope 1⅛″ dia. (2 lbs. per ft.), the maximum hoisting speed 1500 feet per minute, the cage weight 8750 lbs., and the spring tension 3000 lbs.

Then the stopping time must be greater than

$$\frac{2 \times 25}{32} \times \frac{8750 + \frac{6000}{2}}{8750 - 3000} = 3.2 \text{ seconds.} \quad \surd$$

Water . . . is a Forest Product

by

J. L. Van Camp

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Living plants and animals are dependent upon water resources. . . . Water resources are vitally affected by plants and animals. This paper is an attempt to portray the part played by nature, in providing the Canadian people with an abundance of pure water in living form. The greatest hope for success in long range engineering projects lies in working with nature, in manipulating those resources wisely.

The role of water in our most commonplace undertakings is taken for granted. The turning of a tap brings quantities of cold clean drinking water. Like the city youngster who thinks milk originates in the quart bottle, we take water abundance casually, and associate it only with pipes and plumbing. Instead, we should think first of the hills and forests on which it fell, a bounty provided by no act of ours.

There are places even in Canada where water is much less plentiful. With scarcity, water rapidly becomes a matter of critical concern. The wheat farmer of the prairies knows his living is made or lost by the moisture reserve in the soil, aided by the rainfall of the brief season from seed to harvest. Good farming areas of Western Ontario are finding that spring floods and dry wells in summer are part of the same problem. Unnatural water cycle rates, aggravated by bad land use patterns, need study and change for best results, in terms of human health, happiness and security.

The water problem reaches headlines when it touches millions of people. The New York City drought of 1950 caught the attention of the continent from cabinet to cartoonist, and a slight ripple of uneasiness stirred in most of us. The thought of dry water mains in time of fire or national emergency is unsettling. Fundamentally, our dependence on this simple natural resource, is as complete as our need for air to breathe. Water sources are much more easily destroyed or damaged than the air masses, as badly as these may be tainted by smoke and fumes.

Our water supplies may originate half a world away, in vapours rising from oceans and lakes, mountain forests or sphagnum tundra. The polar air masses which determine our weather changes move the vapour-laden clouds, makers of rain and storm. Precipitation is water in the dynamic, descending portion of the hydrologic cycle. Here it comes within our orbit, and for the first time its effects may be managed and controlled for human use. Here, also for the first time in each cycle, the actions of living plants and animals enter in, ready to help bring the water in clear, potable form, by easy stages, to the tide water levels where the cycle began.

Forest Cover

If we have an ideal protection forest clothing the slopes above our headwaters streams, the falling rain comes to earth step by step, from topmost twig of the tallest pine, till it soaks into the forest floor. In contrast to this natural "walking down" process of rain through foliage is the erosive impact of beating rain on unprotected soil. This destructive action has been called "splash erosion". High speed photos show soil particles thrown into the air and moved by each pelting raindrop. These liquid missiles, in countless millions, strike with great impact, to pound bare earth which has no screening effect of trees, shrubs or grasses.

The destructive churning effect of rain on bare soil results in muddy, silt-laden storm waters, which carry sediment into streams and reservoirs, aggravating the costly problem of siltation. Erosion control should be obtained by the most effective and least expensive means possible. In the field of watershed protection no factor fills these two qualifications as well as the natural cover of forest or grassland.

When given protection against fire or reckless logging, the forest mantle is the most effective and economical insurance of the water supply. The free bonus of clear water in abundance, without excessive peaks or lows of runoff, and with minimum silt content, is the ideal condition for power production, pulp wood drives, and the needs and pleasures of the public.

Living Organisms at Work

The fact of water going into the good porous soil is also so commonplace that we accept it like sunrise and sunset. This process is aided by a multitude of living organisms, working to provide the absorbent structure which distinguishes good soils from infertile, compact nonhumus, erosive soils, devoid of organic matter, living or dead. We are all aware of the ground inhabiting animals. The woodchuck or groundhog digs conspicuous tunnels in the edge of the alfalfa field. We see the complicated runways and burrows of the field mice. In the woods, small mammals are equally plentiful; white-footed, and pine mice, moles and shrews are all active in tunnels through the moss and among the roots of trees.

But these are only the larger elements in a community of earth dwellers who perforate the soil in more and more microscopic manner. The spongy humus soils of the woods are not mere inert, dead, and stable structure. They are a teeming factory of minute forms of plant and animal life, each cubic

inch swarming with countless millions of organisms, as necessary as the workers in the mills and factories of our own level.

A few estimates of the quantities of life involved in soils, give revealing evidence of nature working in our behalf. A normal silt loam soil to a plow soil depth of 7 inches includes most of the "top soil". Over this soil is a cover of woods litter, leaves and partly decayed humus, which is protection against mechanical damage by wind and weather. In a cubic foot of such porous soil we might find

Organic matter	5%
Air	20%
Water	30%
Mineral matter	45%

The S.G. is about 2.65, and the volume weight 1.40.

Organic Matter and Insects

The organic matter includes living roots of trees and plants, and the complex fungus partnership known as mycorrhizal or symbiotic relationship. Briefly this consists of enzyme action by the fungus, dissolving raw minerals, and the passage of these salts to the green plants. In exchange some manufactured starches and sugars from green leaves are fed back to the fungus on the roots. In addition, the humus or organic matter is made up of particles of dead roots, leaves and twigs carried down by insect or earthworm action, or by the fungi which absorbed them and in turn died and decayed in the soil layers.

More active than the plants, are the insects, of many tribes, which perforate the soil. These are visible even to human eyes, in anthills, ground beetle, cricket and mole cricket diggings. The total number of soil inhabiting insect species and individuals is stupendous, even for these larger life forms. Beyond the insect groups we have the crustaceans, sowbugs, centipedes, millipedes and wireworms, all busy eating and burrowing through the soil layers, and keeping it loose for water storage.

Coming to the microscopic forms of plant and animal life, we must keep to small units to comprehend the population of these soil workers teeming in the earth. A rough tabulation from one oz. of silt loam would show about these numbers of a few classes:-

Algae	2,800,000
Molds	14,000,000
Protozoa	14,000,000
Bacteria	55,000,000
Actinomyces	280,000,000

This stupendous total per oz., by no means complete, must be multiplied by a factor of 32,000,000 to give the per acre population of these workers in that upper 7 inches of humus soil. Thus we begin to grasp the amazing fact of the multitudes of life forms swarming beneath our feet, working to maintain our vital porous soil structure. In natural form, such soils absorb the bounteous water supplies, brought in by storm, mist, fog or dew.

Rainfall

The water volumes loosed upon an acre are quite large enough in quantity to remove all worry about supply, if used in regulated form. One inch of rainfall per acre equals about 100 tons. With a 35 inch annual precipitation, the owner of a 100 acre farm receives 350,000 tons of water annually, far more than his crops and livestock require. Yet in summer he may be desperate for water, when the streams are dry and the well nearly so. In spring his plowed fields were being cut into gullies by rushing waters, and the soil carried away in tons, if he farmed up and down hill, as too many still do. Without contour cultivation and good grass cover on sloping fields, his plentiful supply of water is squandered in spring run-off.

The natural forest is a water regulating blanket on the land, which reduces extremes of water movement, and equally important, reduces soil movement to a minimum, the natural rate of geologic erosion. Very few completely undisturbed forest areas remain on our watersheds, especially those accessible areas affecting our major power and water developments, and our major population areas. The timber cover on lands draining into our water courses has had a checkered history of clearing for settlement and farming, of cutting for lumber and pulp, of fire or insect damage, and only too rarely a planned management for the best multiple use.

C. R. Hursh, writing on research in Forest Streamflow relations in Unasylva (Vol. V No. 1) says: "The most pertinent of all facts known to date is that careless abuse and damage of the forest soil starts into motion degenerative processes which may be inconspicuous at first, but which can produce gradually accelerating changes in soil structure that ultimately result in damage to the water resource. The conversion of arable areas to desert is the classic example. How to use the land and still maintain a reasonable equilibrium between deterioration processes and rehabilitation processes is a local problem in various sections of the world. Understanding these physical processes is the first essential."

Few problems are more important than the question of stabilized forest cover for timber, water, wildlife and recreational uses. The successful continuance of the power, pulp and paper, and tourist industries is linked to permanent forest resources. The management problem increases with the number of demands on the forest, two of the most important being the production of lumber or pulp, and the regulation of water flow for power from protection forests.

Reforestation

Reforestation to the average man means replanting trees by hand or machine, the so-called "artificial regeneration" of the forestry texts. Often the suggestion is made in conservation meetings that lumbermen or pulp cutters be required to plant a tree for every one they cut. These "notions" of retaining the forest in perpetuity are sincere, but not accurate as to the methods of reforestation suggested.

Tree planting should be regarded as a final resort, to be used only when nature's more bountiful methods of natural reforestation have failed. Under good conditions, in most of Canada's forested regions, the tree seedlings ready to take the place of the mature tree are counted in dozens or hundreds, for every tree which dies and falls to earth. The problem is complicated when human use or abuse of the forest destroys some or all of this coming crop, or leaves the soil and moisture conditions so impoverished that new tree growth fails to survive. At this stage replanting becomes necessary, costly as it may be, if the forest cover and its water and timber benefits are to be restored.

There are many intermediate stages between the two extremes, the original condition of perpetual forest regrowth, and the worst examples of fire and logging injury to forest lands. Most of our

(*Continued on page 27*)

Engineers Called on to Defend Competitive Economy and Industrial Initiative

by

Carlton S. Proctor,

President of A.S.C.E.,

Consulting Engineer, New York City.

No greater honour, privilege, or opportunity can come to an engineer than election to the presidency of this oldest of national organizations of engineers, the parent society of all civilian branches of the profession. To attain this high privilege and to serve during the year of the celebration of our Centennial, is an honour and an obligation that gives me a deep sense of humility, of grateful appreciation, and a full awareness of the magnitude of the job ahead.

It has become custom for the incoming President, when making his inaugural address at this installation meeting, to indicate the direction in which he will try to steer his course during his year ahead. The importance of this year, with its celebrations, culminating in our great international gathering of engineers in Chicago next September, with a convocation of unprecedented magnitude and importance and with its pageant and exhibits at the Museum of Science and Industry, overshadows all other society objectives and will constitute the core of my year's prime interest. These centennial celebrations will be of significant influence, not alone on the Engineer, but on all society. In clear, simple depiction, we will show to all that America's prosperity and high living standard have resulted from the Engineer's working partnership with management, finance and skilled workmen.

So the keynote to what I hope will be the motivating theme of this year, in the organized activities of every branch and with every gathering of Engineers, is not alone the substance of the celebrations marking 100 years of engineered progress, but of equal or greater importance, the inherent implications and obligations. For if we permit our justified pride in our accomplishments to blind us to the deeper significance of the meaning of our centennial, then we will be unworthy of our heritage and of the genius of those who have made our profession great. Because this centennial will depict much more than a record of grand accomplishments—with its compelling story of the prosperity that is now enjoyed as the fruits of our efforts, there will be interwoven the clear lesson that the success of past efforts would have been impossible, and that the hope of continued progress and creative accomplishment will be unattainable, if the operation of a competitive economy is choked off by the imposition of paternalistic state controls, and restrictions to private enterprise.

The president's inaugural address to the 99th Annual Convention of the American Society of Civil Engineers, in New York City, October 24, 1951.

In this year of the full maturity of engineering, we look back on 100 years during which our profession has played its full part in the development of our country. Particularly in recent years, we have accepted responsibilities and leadership in the solution of non-technical problems in the public welfare.

When the help of the Engineer was sorely needed in our hasty rearmament in preparation for our participation in World War II, the Engineers National Defense Board was created, whereby each of the constituent societies of E.J.C. drafted its selected members for service in the preparation of study reports, codes and research conclusions, that proved invaluable to our war effort and to the balance maintained in civilian production.

When the now fortunately forgotten Morgenthau Plan, for the reduction of all of Germany to a strictly agrarian state, was publicly announced, Engineers Joint Council challenged our State Department and demanded the opportunity to prepare an intelligent program for the industrial demobilization of aggressor states. As the result, the studies and reports of the National Engineers Committee of E.J.C. on the industrial demobilization of Germany and Japan were employed by the allies for a far more rational solution to a problem that would otherwise have come home to damn us in our present strained relationship with Russia. These reports could only have been prepared by men of broad technological knowledge and experience, whose training in thorough analytical thinking inhibited their capacity to compromise with internal or local political considerations of the moment. Wide public acceptance of these works, both here and abroad, demonstrated the public's confidence in applied engineering judgment.

Civilization is now faced with another false politico-economic ideology, far more insidious and destructive than a Morganthau Plan or any that has so far challenged our progress. Of course, I refer to that philosophy which today appears to permeate much political thinking throughout all Europe and the Western Hemisphere. This is the philosophy of "something for nothing"; that only a sucker works any harder than he has to; that the modern machine with its straight line production has eliminated the need for industrious work; that ideas are now a natural resource; that profit to the investor and reward to experience gained through hard work and application, to management, and to creative effort are little short of immoral and can be taxed out of existence without destroying our economy. Far too many of us accept the false thesis

that moral lassitude in public office, public subsidy of indigence and tax-supported boondogling; the trading of the dignity and integrity of the individual for a super-state and the sacrifice of our priceless national heritage of morality, the dignity of work, and the essential place of God in our daily life are but a fair price to pay for the new, abundant, indolent life.

Statism, in its insidious usurpation of the rights, liberties and incentives of the individual, may in its end result be more permanently destructive to human rights than Communism, for the more subtle reason that statism is being approached through the democratic process, whereas Communism has only been enforced on any people through a police state supporting a ruthless dictatorship.

Dr. Lin Yutang has this to say:

"Modern civilization would be destroyed if the things that make civilization, freedom of belief, the rights and liberties of the individual, and that now tottering faith in the common man—if these things were destroyed. Without war, a totalitarian state which deprives men of these gifts of civilization and sets men as spies upon their fellow men has already begun to destroy civilization. With a nation not so easily regimented where the spirit of man remains free, that civilization cannot be destroyed by a war.

"There is every sign of the danger that in contemporary thinking and contemporary life, such common privileges of living are increasingly giving way to the claims of the state-monster.

"And so what threatens civilization is not war itself or the destruction of war, but the changing concept of life values entailed by certain types of political doctrines.

"What is destroying civilization is the tendency to surrender the rights of the individual to the state: such a powerful factor in contemporary thinking".

Even among the most intelligent it has become the style to blame all this on the Government administration in office, on party politics and on almost everything except the real cause; lack of intelligent, honest leadership, that has created a confusion of the electorate in every democratic country and loss of confidence in established political institutions. Every honest, thinking man knows that every administration in office adheres reasonably closely to the attitude of the majority and we all know that government is simply us, every single citizen.

Of all groups in our economy, none in their daily work and in their essential attitude to the accomplishment of their jobs, so completely refute these politico-economic doctrines as does the Engineer. Show me the professional man who works by the clock and the dollar sign; the man who has lost his high sense of values in moral principles, he who no longer believes in the dignity of hard work, in the rights of his fellow man, but accepts the principles of state control of ideas, denial of initiative, and confiscation of risk investment; show me that man and I will show you a charlatan and a menace to his community.

Add to the basic qualifications and experience of the Engineer, the public confidence in which he is deservedly held, and you have my thesis: that immediate assumption of leadership in public thinking is not only the urgent responsibility of the Engineer, but is his best hope of conserving the fruits of the labour of his profession and of modern civilization.

And there is another and equally important opportunity for leadership by the Engineer. Some 22 years ago, the then 2nd ranking Communist leader in Russia told me that their plans and program for world expansion were based primarily on the exploitation of the weaknesses and sore spots within each other nation, particularly the democracies so as to set class against class and stir up labour-management disputes so that they would reap the harvest of resulting chaos. Ever since, in those private conversations in Moscow, it was pointed out to me that ours was one of the most vulnerable societies to communistic encroachment, because our country harboured the greatest extremes in intolerance; religious, racial and sectional: ever since that time I have been trying to point out to Engineers, the power that they possess to oppose intolerance in all its forms.

Many engineers have enjoyed the sort of rich experience that I have, that of working closely and intimately with the peoples of many lands; not those of a single class such as management, labour, industry, press or diplomacy; but the peoples of all classes; for the Engineer must know and hold the confidence of all with whom he works, from the lowest peon to the Governor, if his work is to succeed.

Of the many people of differing nationalities with whom I have worked, I have never known any that I did not like and admire. Some of my most loyal friends are men of faith, race, and culture widely different than my own.

Out of these experiences and friendships in foreign lands has grown my conviction that the unique experiences of the engineer, unique because of the full confidence and trust in which he must be held; place him in the most ideal position to expose to the light of public view, the most cancerous growth in our body politic, our intolerances.

The rich opportunity that confronts the engineer for leadership in guiding men's thinking back to the simple precepts of faith in their God, the dignity of work, and the essential brotherhood of man throughout the four corners of the earth, are poignantly illustrated in Nevil Shute's recent book, "Around the Bend".

If I were a Paul Hoffman to administer the magnificent Ford Foundation, I would distribute a copy of this book to every engineer in every land. Because this book offers the sort of basic philosophy for which men crave, it demonstrates the importance of the industrious life; the reliance that men must place in the engineer for their every-day safety and therefore the internationality of engineering science; the unity of the aspirations and goals of men; and the fact that man's innate desire for brotherhood is thwarted only by evil leadership.

If our great engineering profession in all of its branches could take from this book its clear injunction that theirs is the task of leadership, out of our present international confusion of thinking, away from our soul destroying philosophy of maximum return for minimum effort; then and only then will we have justified our pride in these past 100 years of engineered progress and have proven our rights to the rich legacies in tradition and heritage of great works, that we inherit.

For the ASCE membership this means a dedicated, civic leadership program in every local section. Such programs should include continuous activity and participation in all matters of public welfare, and particularly in subjects relating to the social influences, economic impact, and cultural implementation of the direct products of engineering effort. It requires interest in, and influence on school boards, public works commissions, local, state and national legislation, and above all,

(*Continued on page 27*)

"A Helluva Shortage of Engineers"

by

Lawrence P. Lessing

It will get worse—into 1954—before it gets better.

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The frenzy began early last fall. Before spring, nearly all available young engineers of a June graduation class of 38,000 had been snapped up into jobs, and employers continued to fill advertising columns with pleas for more engineers, almost any kind of engineers. The U.S. by then was in the midst of a new social phenomenon and the most disturbing of all manpower crises.

Talent scouts combed and recombed engineering campuses from coast to coast, their briefcases bulging with contracts, interviewing and exhorting prospects. They represented over 4,000 companies, and many were accompanied for the first time by presidents or vice-presidents. For the first time, on-the-spot hiring was common. Typically, three-men teams from such companies as G.E. would arrive on a campus, hold a pep-talk rally, get down to interviews, and within a day begin handing out contracts ranging from $290. to $375. a month. Some offered all-expense trips to the home office for a clincher. One company sent out twenty-two of its own engineers to conduct interviews, got back only twenty-one. The other was lured away by another scouting team on his travels.

To add to the scramble, government-agency scouts made their first appearance on the campuses. Since Civil Service rolls had run out of engineers months before, the government was forced to bid against industry. There was no talk of Civil Service examinations and a wait of six months. "Here," said the government man, "fill out form 57!" and then, "You want this job?"

The Big Scramble

The industries scrambling hardest for engineers ran in this order: aircraft, chemical, electrical, automotive, oil, and mechanical-equipment makers. But there was hardly an industrial category not in the market. One company made a blanket bid for the entire graduating class of Southern Methodist University, Lockheed Aircraft tried to hire the whole junior class of Georgia Tech's School of Aeronautics, plus professors, just for the summer, to get one of its reopening aircraft plants into production. Aircraft engineers were so scarce that the situation led to the rise of "flesh-peddling", agencies, deplored by both industry and the profession. Dummy engineering companies hired batches of engineers outright on contract, then hired them out to aircraft and other companies at advanced salaries, pocketing the difference.

The engineering student suddenly found himself rivaling the football star as the glamour boy of the campus. As graduation drew near, he had to budget his time closely to get in all the interviews. He might have thirty interviews by as many companies in three weeks' time. Case Institute of Technology's 320 graduates had a total of some 1,400 job offers, and Massachusetts Institute of Technology's 1,175 had over 3,500 offers. The going market rate was $290 to $325 a month for a bachelor of science, $350 to $400 for a master's, and $450 to $750 for a Ph.D. But smart operators, by holding off and allowing the bids to mount with each wire or telephone call, could better the rate. One twenty-five-year-old, with a B.S. and some war-time experience in radar, had seven firm offers. He settled on Hughes Aircraft at $450 a month to start. Generally an engineer must have two to four years' practical experience before he can be registered in the profession. For engineers not yet full-fledged, these constituted the highest starting rates in history.

University placement officers were equally harassed and bug-eyed. "We have never seen anything to compare with this spree," said one. "Even our worst students have had at least three offers," said another. Georgia Tech's Fred Wesley Ajax thumbed his files last spring and distractedly observed, "I'm already 90 per cent sold out on the 250 who will graduate in September, so I'm starting to work with the December crop—it's short, only 128, while last December we had 300." University of Denver's Fred Bruntz was worried. "These companies come out here begging for boys . . . I don't know whether it's healthy. These kids should have seen the thirties, then maybe they'd appreciate it." But the pressure and pace never slackened.

The shortage of engineers, far from easing, is growing worse. Through 1952 and 1953 it will be more critical to the welfare of the nation than the shortages of steel or chromium or molybdenum or nickel or tungsten or a dozen other materials that are only the base materials of engineering. Nearly all scientists are even more dangerously short for the magnitude

EDITOR'S NOTE:—

While it is admitted generally that the pendulum of events swings farther in the United States than it does in Canada, the fact remains that events here do move in the same direction. Therefore the following vivid account of what has happened to the supply of engineers in the United States can be made to apply to Canada, albeit to a lesser degree. Canada's shortage is serious and is increasing, but it is still far from equalling that in the United States. *The Engineering Journal* is greatly indebted to the publishers of *Fortune* for permission to republish the article.—ED.

of the U.S. defence programme, but none are short in such numbers as the engineers.

The present running deficit is well over 60,000 engineers, against a total of 350,000 to 450,000 employed in all categories. That figure came out of a telegraphic survey of industry, made after the 1951 graduating class had been absorbed, by an Engineering Manpower Commission recently formed by the Engineers Joint Council, a body representing some 130,000 engineers and members of the five leading engineering societies. The figure does not include military needs for engineers. It is the more remarkable for the fact that the previous year had seen an all-time high graduating class of 52,000 engineers, peak of the postwar G.I. influx. But these were swiftly absorbed, and the demand continued to mount while 1951 graduation rolls slipped about 14,000 below 1950. On the basis of present enrollments, the 1952 class will be a slim 25,000, 1953 a slimmer 19,000, and 1954 an emaciated 12,000 to 17,000. Since about half of these will be drafted, this will leave industry and vital government research on the shortest rations of prime technical personnel in years. Merely to keep its technical staff stable, U.S. industry needs a minimum of 30,000 new engineers a year.

A History of Folly

Part of the serious decline in engineering classes is caused by the low birth rate of the thirties, when the great depression not only failed to produce goods but more tragically failed to raise children. But deeper than this lies a tissue of wrong policies, wrong thinking, blunders, national obtuseness and indifference. Like so many other present ills, this one has arrived not without warning. Various scientific bodies began urging action before the last war ended. *Fortune*, among others, had something to say on this issue in June, 1946 ("The Great Science Debate"), and again in October, 1948 ("The Scientists"). But few attempts at national policy have had such a history of folly and stupidity as the attempt to nurture scientific and technical talent, today so vital to the growth and preservation of the nation.

The folly began in World War II when indiscriminate U.S. draft policies, which no other modern nation even espoused, practically gutted the production of future scientists and engineers. Not even the heavy graduating classes of the immediate postwar years made up the four-year-long drought and deficit.

Right after the war, the great and largely voluntary wartime scientific establishment was allowed to fall apart, except for atomic energy and military research, which were kept going. The National Roster of Scientific and Specialized Personnel, a running inventory of special talents and where to locate them, went into dusty storage for lack of a few thousand dollars to keep it running. Fearing all this, the President, acting on a report by Vannevar Bush, retiring head of the wartime Office of Scientific Research and Development, proposed in 1945 a National Science Foundation to carry on and expand federal support of basic research and education of scientists and technicians. Bills were repeatedly introduced. It took five long years to get one through the thick skull of Congress. Then only a last-minute battle by engineering organizations got engineering included in the basic research to be fostered.

When the Science Foundation came up for its first year's budget of $475,000 in the last days of the 1950 Congress, an economy-rabid House struck it out, and only under goading did the Senate restore $225,000. This piddling sum, set beside the billions voted for military hardware, the billion or so for atomic destruction, and about $600 million for strictly military research and development, accurately measures the Congress' crass ignorance of the real foundations of the civilization it thinks it is defending. Billions may be poured into mere brawn and steel, or into mere applied research on weapons, but unless these are animated by a rising stream of basic science and technical brains they will come to nothing. And periodic notes of a U.S. lag in developing or producing jet aircraft, guided missiles, tanks, and other paraphernalia would indicate that brains are seriously short. With a budget barely big enough to organize a limited office staff this year, the Science Foundation cannot begin to support basic research and the training of young scientists before 1952—House and Senate willing. Thus a total of six years has been lost in starting an organized attempt to plant the seed corn of basic science, from which all new industrial and military developments are nourished.

Folly Compounded

When the present emergency arose to increase the armed forces, the military seemed disposed to commit all the errors of World War II over again. A blanket two-year hitch of service was pressed for all eighteen-to-twenty-six-year-olds, which would have turned the present scientific manpower shortage into a bonedry drought and decimated the production of young technicians through the middle fifties. Various remedies were proposed. The most trenchant and comprehensive plan was rushed through the National Security Resources Board by a high-caliber Scientific Manpower Advisory Committee, headed by Monsanto Chemical's President Charles Allen Thomas. Its key proposal was a powerful over-all board to rule and husband the nation's scientific manpower. More will be heard of the Thomas committee's plan later on. In the middle of its political, troops-for-Europe debate last January, Congress practically ignored it.

Finally, Selective Service, assisted by its advisory panel of scientific and educational committees, headed by M. H. Trytten of the National Research Council, pushed through the plan whereby all students now in college are eligible for deferment upon scoring seventy or better in a special nationwide test or on maintaining a satisfactory level of scholarship. It received some thoughtful opposition from a few educators, such as Harvard's Dr. James Bryant Conant, who, supporting Universal Military Training and admitting no immediate war threat, feared the new plan would undermine democratic military service. It also raised a raucous outcry against "bright boys" and "the creation of an undemocratic elite" from know-nothing spokesmen, columnists, and newspapers, who vie with Congress in determined ignorance of the modern world and suspicion of the use of brains.

But even this great, new experiment in developing a sustaining supply of brain power, whose results cannot yet be foreseen, is too broad and diffuse an instrument to focus sharply on the technical-

manpower problem. Deferments for college training still rest on the variable discretion of local draft boards. Eligibility for deferment is almost wholly confined to students financially able to go to college. Nothing in the new plan ensures an increase in technical training; indeed, some educators fear it will deflect students to easier or "snap" courses. Moreover, the new Selective Service law of which it is a part has two debilitating features. There is no rationalization of the calling up of reserves. Since some 25 per cent of U.S. industry's technical staff is in the reserves, call-ups continually disrupt technical programmes. And the new law extends the draft liability of those deferred from age twenty-six to thirty-five, putting a still greater part of industry's technical staff in jeopardy.

If the military made good use of the engineers it called or drafted, there would be less basis for criticism. But one Army camp surveyed had sixty engineers, largely N.C.O.'s and privates, spending half their time on the endless, pointless household drudgery of army encampments. And of the 19,000 young engineers, or half of last June's graduating class, called into service this year, the bulk are occupied not in engineering but in the medieval nonsense of strictly military service.

Meanwhile, industrial research and development, the real base of modern military power, is already being limited not by dollars but by lack of technical men. "If we continue with our present method of Selective Service," said Monsanto's Charles Allen Thomas at Washington University last summer, "if we continue not having a plan that the colleges can understand, if we continue without understanding this problem and planning for it, by 1954 we will have only 6,000 graduates in engineering, science, and technology available to industry. The demand today, this June, is well over 100,000. In 1954 no one can tell what the demand will be, but there will be 6,000 available."

Blunders Continued

To top all other bones, early in 1950 a statistical chart slipped out of the Bureau of Labour Statistics, which indicated that there was a growing oversupply of engineers for available jobs. This release naturally was widely circulated, posted in classrooms, and picked up by the press, notably by such pervasive national magazines as Life. And this at a time when conditions were running exactly the opposite. Since engineering-school enrollments usually follow closely on economic demand, many engineers believe that this false report, discouraging students, is partly responsible for the slim engineering classes now coming up. The BLS was led into its egregious blunder largely by a group of midwestern university advisers, bemused by the number of G.I.'s then swamping engineering schools and unable to see how they could all find employment.

But what these and other authorities continually overlook is the enormous postwar technical growth of industry—so great as to constitute a new technological era—as well as the technical revolution in warfare wrought by World War II. Between 1940 and 1951 there was a 1,500 per cent growth in U.S. Government research (from $67 million to over $1 billion), mostly military. By 1952 some two-thirds of all available U.S. scientists and technicians will be needed for this huge government program. In the same period industrial research has jumped almost 500 per cent (from $350 million to about $2 billion), with a corresponding increase in complexity and technical requirements. Aircraft companies, for instance, need three times the number of engineers per unit of development as were required ten years ago. And the overall industrial ratio, which had been one engineer to 100 factory workers through most of the thirties, is now about one to seventy, and steadily narrowing. Meanwhile, the number of scientists and engineers graduated in ten years has scarcely doubled, which is why the pressures on them are now intense and will grow worse.

But is it a Profession?

To the engineer, all this attention is both belated and unfamiliar. For decades he has been struggling for recognition of engineering as a distinct profession, and while World War II brought a new appreciation, his journals still feature self-analytical little articles wondering why his public status is no higher. The scientist has managed to hoist himself in the public eye, but the engineer is still confused with railroad enginemen and other oil-begrimed machine tenders by many people, radio commentators and Congressmen. The stock engineering figure on a slightly higher plane is Gregory Peck in shiny boots and whipcord breeches, waving his arm over a transit, bossing some stupendous construction. Only by repeated beatings over the head have draft boards been moved to consider engineers occasionally important enough for deferment. There is, in fact, a great deal of confusion and obfuscation over engineering's exact role in society.

This is all the more surprising in a country that leads the world in engineering. Indeed, nearly all the nation's chief glories—the skyscrapers, the great factories, the 86 million kilowatts of installed power, the 78,000 miles of airways, the vast broadcasting and telephone networks, the sweeping concrete highways, and all the vehicles that ride upon them—are works of engineering. An even more pervasive engineering work, which orators never tire of trumpeting, is the U.S. standard of living. With only 6 per cent of the world's population and only 5 per cent of its land area, the U.S. accounts for roughly half of all the world's industrial production. This pitch of productivity, new in history and rising at the rate of about 3 per cent a year since 1900, is the achievement of engineers working endlessly to devise and improve the tools, methods, materials, and end products of mass production.

For all this, the engineer is strangely anonymous. The throngs moving through, over, and around some of his greatest works, such as Grand Central Station in New York City, neither know nor are curious about the men who conceived and built them. To achieve fame an engineer must generally become something else. George Washington and Herbert Hoover are prime examples. To achieve fortune he must likewise generally make it in something other than engineering, such as corporate management. The average of all U.S. engineering incomes last year —overweighted with such fringe categories as draftsmen and shockingly low-paid road engineers—was about $5,700. Even with inflation, the average for a good engineer after twenty years of practice is not much over $8,000 to $10,000 a year.

Though supply and demand are now beginning to change this, the lack of recognition and concomit-

ant lack of rewards have not made the profession a lodestone. It has never been able to attract more than 3 per cent of the secondary-school population. Perhaps much of the reason for all this lies in the history and development of engineering, now in transition, which closely parallels that of the human race. Unlike the experimental scientist, who sprang from the brow of the Renaissance as an almost entirely new phenomenon, the engineer traces directly back to earliest times, never far removed from the hard manual labour and skilled artisanship by which man slowly built his dominance and powers.

The Founding Societies

The inventors of fire-making apparatus, the wheel, the mining and recovery of metals were all great early engineers, as anonymous as some of their followers. As nations grew, the function of the engineer was almost entirely dominated by the state, under the military, in the building of great public works, all seven wonders of the ancient world, the great roads, bridges, tunnels, and aqueducts of the Roman Empire. Until the eighteenth century there were only military engineers. In the great expansion of trade and industry leading up to the Industrial Revolution, engineers found other employment and, to distinguish themselves from the military, called themselves civil (or civilian) engineers.

By then engineering had amassed a cohesive body of empirical knowledge and practice, and engineers, in the spirit of the Age of Enlightenment, began to form clubs to advance their knowledge and status. The profession of engineering dates from that time. The first Society of Civil Engineers was formed in England in 1771. The first national American Society of Engineers was incubated in New York in 1852. At that early date, civil engineering embraced nearly all engineering outside the military. It was made up largely of the empire builders, the surveyors and builders of cities, roads, bridges, harbours, canals, and, in the westward sweep, railroads. Among the first technical papers considered by the society was a study of traffic conditions in lower Manhattan, a problem with which engineers are still wrestling. With the rapid development of the steam engine and new knowledge, independent groups set themselves up or broke away from civil engineering to form specialized societies: the American Institute of Mining and Metallurgical Engineers in 1871, the American Society of Mechanical Engineers in 1880, the American Institute of Electrical Engineers in 1884. These, plus Civil Engineers, formed the four founder societies of U.S. engineering.

In the amazing division and extension of science over the turn of the century, however, still more engineering societies sprang up. Among the first and loftiest was the American Institute of Chemical Engineers in 1908. In addition there arose sanitary engineers, heating and refrigeration, automotive, aeronautical, acoustical, radio, illuminating, and so on, until today there are some seventy-five different national engineering societies. In this proliferation the engineering profession found its modern function, not yet completely realized nor accomplished without lag, which is the translation of the ever faster-moving discoveries of science into physical and usable forms Thus engineering became that bridge, mentioned in the first English charter of 1828, over which man passes to get into nature to control it, to guide it, to understand it.

Struggle for Status

But, as engineers soon found out, the organization of professional societies did not automatically create a profession. The recognized professions were three—divinity, law and medicine—and their prerogatives and class distinctions had been jealously guarded for centuries. The man of verbal accomplishments, though he might preach or utter nonsense, had no difficulty in feeling superior to the rising upstart who designed bridges, especially as the bridge builder was so lately risen from the toiling classes. Most of the early English engineers were millwrights, and it was said that the mechanics who tinkered with and ran the early mine-shaft and canal-lock machinery merely put on white shirts to become mechanical engineers. To bolster these economic and class prejudices, the ruling professions had some deep philosophical tenets, which still plague science and the practical arts. The knowledge that was gained by hard work, experimentation, and close observation of nature was held to be somehow inferior to the knowledge that other men gained by staring vacantly out a window or consulting the urgings of their own poorly understood nervous systems.

And the engineer himself had deficiencies that made professional status hard to come by. The new occupation attracted, and still attracts, many ambitious, mechanically inclined, practical men from the lower income classes, who seized upon engineering as a rung up the ladder and were more interested in making things work than in learned studies. Unable to get their training in the early universities, devoted to the classic professions, candidates turned to the technical schools that arose to meet the needs of the Industrial Revolution. While European engineers were soon required to have at least a firm grounding in science, U.S. technical schools as late as the twenties were little more than glorified vocational schools, grinding out by rote engineers for industry.

Since industry needed them in large numbers for everything from product development to plant and process design to technical sales, engineers became largely hired men, buried in vast engineering departments. (Seven out of eight engineers today are industrially employed on salary.) The typical product of this drive was a narrow, inarticulate specialist, self-centered in his technical section, uninterested in human or community values, but amenable to anything that worked or paid. Often he aspired to management, but regularly he saw the plums go to the traditional financier, lawyer, or salesman. The best of engineers, who generally became teachers or consultants, upheld the professional ideal, but cohesion as a profession was slow to develop. Perhaps this was the price to be paid for the rapid industrialization of the U.S.

The Profession Rises

All this is changing. Criticism from within and without has cast engineering into a transition that may well be hastened by the rising national need for high engineering skills. Much change already has been quietly accomplished. A forty-year battle by various engineering bodies, led by the founding A.S.C.E., has finally put on the books of all forty-eight states and U.S. territories a generally uniform "model" registration law to

guard the standards and practices of engineering. A parallel drive by an Engineers' Council for Professional Development, supported by the founder societies and others, has worked out a system for accrediting engineering schools on standards as rigorous as those of the American Medical Association. And the education of engineers, under reform by nearly all institutions, has steadily broadened. Engineering now ranks with finance, sales, and production as a supplier of top managerial talent for industry.

The move to secure a single, cohesive voice for the profession is also making some progress. Various attempts have been made over the years to join the sprawling number of technical societies into a superbody to speak for the profession as a whole on matters of public policy. Two organizations now show some promise of cohesion. One, formed in 1934, is the National Society of Professional Engineers with headquarters in Washington and a membership of some 25,000 registered engineers. More recently the Engineers Joint Council, set up on a broader base by the four founder societies and the Chemical Engineers, launched a broad program. Four alternative plans are now being circulated for study among the societies looking toward creation of an over-all organization either under E.J.C. or N.S.P.E., or as a separate new body. The difficulties are still considerable for engineers are anything but homogeneous. Those employed by industry tend to take on the complexion of free-enterprise industry, those employed by public agencies reflect governmental attitudes, while consulting engineers are a breed apart.

Nevertheless, both E.J.C. and N.S.P.E. are taking steps to better engineers' public relations, get wider acceptance of their ethical code, and increase the involvement of engineers as a professional group in community activities and the responsibilities of citizenship. E.J.C., for instance, has committee panels on U.S. water policy, science legislation, medical research, and international relations (to encourage the exchange of technical information among the United Nations and technical aid to backward countries). And E.J.C. was called upon by the National Security Resources Board to make a continuing study of the profession's most pressing problem, the manpower shortage. E.J.C.'s Engineering Manpower Commission has jumped into this with both feet, making authoritative surveys, recommendations, and moves to alleviate the situation. It has started a campaign to proselytize high-school students in an attempt to raise the percentage of students entering engineering in the future. It is pushing a program to make better use of the engineers available in military, government, and industrial employment. Overlapping and duplicating government research programs, which are prolific in "pet" projects, waste a great deal of engineering talent. E.J.C. is pressing for special training programs within industry to augment technical manpower. And it has proposed what no other profession has yet proposed: a national registration of all engineers up to the age of seventy to supply a definitive roster for the deployment of engineers in any eventuality.

The Big Problem

No single solution is likely for the growing technical-manpower problem. For one thing, nothing much can be done about increasing enginering classes from now until 1954. The bodies are simply not there. For another, in a period short of war, with a let-down growing, the complexities of channeling technicians by persuasion, higher salaries, and cutbacks into essential defense industries are as involved as the half-peace, half-war economy itself. The problem is further complicated by falling, as usual, between the stools of innumerable government agencies, none yet having the power or gumption to take firm measures for improvement. No fewer than half a dozen agencies are concerned in the problem—The Office of Defense Mobilization, the Office of Education of FSA, the National Security Resources Board, the Department of Labor, the Department of Defense, Selective Service—and the number of surveys, reports and committees is truly fearsome. Technically ODM has the power to seize the tiller, but so far it has only a general advisory Manpower Policy Committee and a Committee on Specialized Personnel scanning the problem and issuing outcries on its proportions.

The nearest thing to a single solution is embodied in the ignored Thomas committee plan, endorsed by all the leading engineering societies and such potent scientific organizations as the American Chemical Society. Its main proposal is a National Scientific Personnel Board to be created at the top executive level of ODM or in an integrated National Manpower Administration to centralize power over the technical-manpower problem. It would recommend to the President the proper channeling of technical men into critical areas of military service, industry, teaching, and government research. The Thomas committee also proposed a detailed program for maintaining the flow of men into technical training and U.M.T., and creation of a Reserve Specialist Training Corps similar to R.O.T.C. to train 75,000 technical men a year. The main need, however, is for some centralized body with power to combine the many measures proposed and bring some order to the mad scramble for a short and diminishing supply of technicians. If this scramble continues it may well throw monkey wrenches into critical parts of the defense program.

The Deeper Malaise

Before any lasting solution to the scientific and technical shortage can be found, a long-needed shift in national attitude may be required. The U.S. came out of the last war with an intelligentsia tired of the mechanical riot, the overpowering complexity and potential destructiveness of science, and ready to call for a slowdown in favor of the more peaceful liberal arts. This was heightened by attack upon science and scientists, both political and professional, and by attempts to reinstate medieval classic studies to their old position of dominance. Yet the stark fact is that all postwar warnings of an over-emphasis on the physical sciences or an oversupply of scientists and technicians have been not only unwarranted but harmful, and the nation must now deal with a malaise that is running deep.

Enrollments in chemistry, for instance, are beginning to drop below prewar levels, in spite of the fact that the industry has had a 400 per cent growth since 1940 and is still growing. General Aniline and Film used large advertise-

ıents last Spring to plead with igh school students to consider he great growth and rich rewards f the chemical industry in choosıg a career. Enrollments in physcs, following an initial postwar purt, are likewise down. The fact s that much of the reason and ;lamour have been departing from he pursuit of the sciences, which ıre nothing if not directed toward he betterment of man. While cience and engineering have been ıeld up as less and less honorific ›ursuits, society has been directing hem ever more thoughtlessly and ›ersistently to destructive ends. Those are not the ends to fire the imagination of youth. Some reıabilitation of the idea of progress s needed—a vast technical program for raising the living standırds of neglected countries, for nstance, to offset the vast military ›uild-up — if science is not to vither and endanger the life of society.

A dictatorship has no such unɜasy problem or conscience. The U.S.S.R. is training by fiat some 100,000 technicians a year, and directing their employment as it sees fit. The U.S. being no dictatorship, must find ways social, voluntary, and democratic to beat that qualitatively if not quantitatively. That is why Chemical and Engineering News solemnly warns the country: "The fast approaching bottleneck of too few scientists and technologists can well be the most efficient weapon possessed by Stalin and the Politburo".—THE END.

Shocking Fact Sheet

There is a present shortage of some 60,000 engineers.

Industry needs some 30,000 engineers a year for normal replacement and growth.

Production of engineering graduates is tapering off from 25,000 in 1952 to a possible low of 12,000 in 1954.

By 1954, if present draft policies still prevail, only 6,000 new engineers and scientists may be available to industry.

While industrial research and development have increased nearly 500 per cent in ten years, and government research even more, the number of U.S. scientists and engineers has barely doubled.

Russia is estimated to be training young scientists and technicians at the rate of about 100,000 a year. √

CIRCUIT BREAKER TESTING

(*Continued from page 10*)

short-circuit current, due to the resistance of the arc. In making tests of this nature, it is necessary to make a preliminary test with the circuit breaker terminals short-circuited, in order to determine the short circuit current which would flow, if the circuit breaker were not present in the circuit.

Conclusion

These oscillograms give some indication of the capabilities of a modern test plant, when applied to the testing of circuit breakers. The plant is capable of carrying out many other forms of testing. For example, fuse testing has received a great deal of attention in recent years. The development of reliable high-interrupting capacity fusegear is directly attributable to the facilities offered by modern testing stations. The short circuit testing station is an essential tool in the process of the design of the various circuit interrupting devices. Moreover, it is the only means of determining the elements of severity in the process of circuit interruption. Even today, this process is not completely understood, and research is a constant duty of the testing station. √

WATER IS A FOREST PRODUCT

(*Continued from page 19*)

forest land within reach of industry has been cut over, and the original growth of "virgin" timber removed. The land now bears a second or third growth of timber in varying size and density classes. Species similar to the original forest may now predominate, or logging, fire and other uses may have replaced those trees with other species, some desirable, others perhaps less useful.

Whatever the present situation, the future demands of a rapidly expanding Canadian population, will call for the best in forest management, for timber, water and power production. Nature has been at this water cycle business for many millenniums preceding our recent century or less of trial and error. Let's give nature a chance to be a partner, the willing, tireless and efficient operator of the greatest water supply and filtration system ever devised, on the slopes of Canada's green hills, our forest and water heritage.

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ENGINEERS CALLED TO DEFEND COMPETITIVE ECONOMY AND INDUSTRIAL INITIATIVE

(*Continued from page 21*)

the exercise of political and economic guidance in public affairs.

For you as an individual engineer, it means an active interest in your local section and its possibilities for leadership in your community. It means your taking the lead when necessary in the development of those possibilities. It means your willingness to accept and to work on committee assignments, local and national. In short, it means that each one of us must use for public as well as for personal welfare, the engineering common sense that the practice of our profession instills in all of us.

The 400,000 engineers of our nation possess today a magnificent opportunity for the profession's greatest contribution to the cause of civilization. I hope the American Society of Civil Engineers will accept its full share in making such a contribution during the coming year. √

FROM MONTH TO MONTH

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

ASME-EIC International Council Meeting

It has become the custom for this joint body to meet at least semi-annually, usually on the occasion of the annual meeting of each society. The latest meeting was held at Atlantic City on November 29, 1951 at the annual meeting of the American Society of Mechanical Engineers. The Institute representatives present were John G. Hall, Dr. O. W. Ellis of Toronto, G. N. Martin and L. Austin Wright of Montreal. The remaining member Dr. W. A. Newman also of Montreal was unable to be there. The representatives of ASME were A. C. Pasini, Detroit; C. E. Davies, New York; C. R. Davis, Toronto and W. R. Trusler, Toronto.

Business on the agenda dealt with the new agreement (see Dec. *Engineering Journal*, page 1195) participation of E.I.C. members in work of ASME Power Test Codes Committees, participation of members of each organization in technical sessions or programmes of the other. Most important of all was a discussion of the proposal to hold a regular meeting of the ASME Boiler Code Committee in Canada, and the part that this International Council could play in completing arrangements such as hotel reservations, accommodation for meetings, speakers, special guests, publicity and non-member participation.

Following the established rotation the chairmanship was returned to Canada, Dr. Ellis being elected to the office. It was agreed that as the Institute annual meeting for 1952 was to be at Vancouver, the next meeting of the Council would be at Toronto in April to coincide with the proposed meeting of the ASME Boiler Code Committee.

Presidential Nomination

At the time the report of the Nominating Committee was published in the October issue of the *Journal*, it was not possible to include the name of the presidential nominee. We now have much pleasure to report that Council at its December meeting approved the nomination of Vice-President J. B. Stirling, LL.D., B.SC., M.E.I.C., as President for 1952.

Mr. Stirling is president of E. G. M. Cape and Co., general contractors, and has been active for many years in Institute affairs.

Cover Picture

A large installation of aluminum busbars at a Beauharnois substation of the Beauharnois Light, Heat and Power Co. is illustrated on this month's cover. Aluminum busbar is coming into extensive use by power companies because of its light weight, economy and high conductivity.

Photo by courtesy of Aluminum Company of Canada Ltd.

ECPD at Toronto

For the first time in its thirteen years of membership in the Engineers' Council for Professional Development, the Engineering Institute of Canada held a localized conference of its representatives on ECPD committees. It took place at the Royal York Hotel, Toronto, on Monday, December 17th.

The main purpose of the meeting was to examine the work of the various committees in terms of needs and opportunities in Canada. Almost all of the Institute's representatives had attended the annual meeting of ECPD at Boston in October, and it was arranged there that they should come together again in Canada in order to capitalize for Canadian engineers the various developments and proposals that had been disclosed there in reports and discussions.

It is recognized that conditions are not identical in the United States and Canada, and that therefore proposals for one country may not be wholly applicable to the other. For instance the accrediting of curricula which has been such an important factor in engineering education in the United States is not nearly so important in Canada. However, there is something for Canadians in every ECPD activity, and the Toronto conference had as its objective, the determination of those points which were of first importance to Canada and the Institute.

The meeting was held under the chairmanship of Past-President Dr. L. F. Grant, the Institute's representative on the executive, and vice-chairman of ECPD. Others in attendance were E. V. Buchanan of London, on the Council of ECPD

and also the Committee on Professional Recognition, Dr. C. R. Young of Toronto, the Committee on Ethics, G. B. Moxon of Montreal, Guidance Committee, W. S. Wilson, of Toronto, Education Committee, R. C. Flitton of Montreal, Committee on Training, J. F. Harris of Toronto, Student Development Committee, and L. Austin Wright of Montreal on Information Committee.

The work of each committee was reviewed both from the point of view of the United States and of Canada. Special consideration was given to guidance for high school pupils as part of the work of the Guidance Committee, and for undergraduates by the Student Development Committee and also the Institute's committee on the Training and Welfare of the Young Engineer. The relationship between all these interests and the Canadian Committee for Student Guidance in Science and Engineering, was also discussed at some length so that all could be more closely integrated in the work of providing guidance to high school pupils, engineering undergraduates and young graduates. Recommendations with regard to future policy are to be made immediately to the Council of the Institute.

The main reference to the work of the Training Committee had to do with the Monteith Report. This monumental piece of committee work was prepared primarily to meet the situation in the United States, and deals with the development of the young man in his first five years out of college. It breaks down the problem into six divisions, the three principal ones from Canada's point of view being Orientation and Training of the Young Engineer, Continued Education of the Graduate, and Integrating the Young Engineer into His Community.

It was agreed that not all of the programme was applicable to Canada, but that some portions of it could be used here to good advantage. Dr. Grant reported on the rapid extension of the lecture courses for young engineers which he had initiated at Toronto last year. These courses are now operating at six centres, and more are in the course of being organized. This form of training comes under the division of Continued Education.

At the conclusion of the meeting Dr. Grant left for New York to attend the following day, a regular meeting of the executive committee of ECPD.

E.I.C. Representatives on ECPD for 1951-52

At the annual meeting of the Engineers' Council for Professional Development, of which the E.I.C. is a member body, held at Boston, October 19-20, 1951, the following members of The Engineering Institute of Canada were appointed to hold office:—

E.I.C. Representatives:

L. F. Grant, field secretary, E.I.C., Toronto, Ont., vice-chairman and member, executive committee.

W. J. W. Reid, president, Otis Elevator Co., Ltd., Hamilton, Ont., member, executive committee.

E. V. Buchanan, general manager, Public Utilities Commission, London, Ont.

The following are E.I.C. representatives on the various committees:

Guidance:

G. B. Moxon, mechanical engineer, Aluminum Company of Canada, Ltd., Montreal.

Education:

W. S. Wilson, assistant dean and secretary, Faculty of Applied Science and Engineering, University of Toronto, Toronto.

Training:

Ralph C. Flitton, sales manager, Canadian Vickers, Ltd., Montreal.

Recognition:

E. V. Buchanan, general manager, Public Utilities Commission, London, Ont.

Information:

L. Austin Wright, general secretary, The Engineering Institute of Canada, Montreal.

Ethics:

C. R. Young, dean emeritus, Faculty of Applied Science and Engineering, University of Toronto, Toronto.

Student Development:

J. F. Harris, Canadian Breweries Ltd., Toronto.

Adequacy of Standards in Engineering Education:

L. F. Grant, field secretary, The Engineering Institute of Canada, Toronto.

New Branches for Fredericton and Prince Edward Island

The October issue of the *Journal* contained a report of Council approval having been given for the formation of two new branches, one at Rimouski, Que., and the other at Sherbrooke, Que.

These branches were duly inaugurated as the Lower St. Lawrence and Eastern Townships Branches on October 12th and November 9th, respectively, and a full account of the proceedings will be found in the Branch News Section of this issue.

At the Council meeting held in Rimouski on October 13th, applications were received and approved for the establishment of two additional branches both in the Maritimes.

The Prince Edward Island Branch was inaugurated at a meeting held in Charlottetown on December 12, while the inauguration of the Fredericton Branch took place on December 7. The president and general secretary were present on both occasions and a full report is contained elsewhere in this issue.

This brings the total number of Institute branches to thirty-seven and the steady growth in activity as well as membership is indeed gratifying.

Correction

The date of the Maritime Professional Meeting at St. Andrews, N.B., previously announced erroneously for September 1-5, 1952, will be September 10-11-12, 1952. Those planning to attend are asked to note this correction.

Correspondence

Clarence House,
St. James.
21st December, 1951.

The Duke of Edinburgh was most interested to see a copy of your *Engineering Journal*, and noted how well you have reproduced the address that he made in Edinburgh.

MICHAEL PARKER,
Private Secretary to
The Duke of Edinburgh

Halifax, N.S.,
November 14, 1951.

First, I would like to take this opportunity of expressing my thanks to the "Journal Staff" for the excellent job that they are doing each and every month.

I have been a *Journal* reader for about five years, and have seen in this time some wonderful improvements; not only in the articles presented but also in the excellent advertising layouts.

An article of particular interest to me appears in the September issue: "Management and Public Relations". This article, to my mind, exemplifies the type of article which should be sponsored almost exclusively by the *Journal*. The detailed technical articles, which we require, should be left to those publications dealing more intimately with the specialized branches of the profession.

WILLIAM J. PHILLIPS, S.E.I.C.

This Light is Not Under a Bushel

At first it was difficult to realize that the piece of paper was really an unsolicited invitation to come and see for yourself all that was being done by McGill in the field of gas dynamics research. One carries forward from past experience the idea that research is both secret and sacred. It is a bit of a shock to find suddenly that the doors of the laboratory behind which so much original work has been done for many months on so important a project actually are open to anyone who would care to see what goes on.

This is not an isolated case of bringing research to the public but the practice is still so new that the public is not yet used to it. It is a good idea. It should result in a better appreciation of the problems that researchers are wrestling with and of the results which they are able to obtain. All this should lead to a better support of research, manifested in a financial way, in sympathetic understanding and in professional recognition.

On December 14th, a miscellaneous group of about 45 people in response to the invitation, gathered at the gas dynamics laboratory of McGill University on Lakeshore Road at Macdonald College, Ste. Anne de Bellevue. The building itself was erected as a college armoury, but it has worked out quite well in its new job. Doubtless there were many heartbreaks for the persons who worked out the metamorphosis, and perhaps there is still much to be wished for, but to the visitor it looked neat, tidy, commodious and efficient.

The visitors were received by Dr. J. J. O'Neill, M.E.I.C., the Vice-Principal of McGill and Dean of the Faculty of Engineering, who was ably supported by Professor D. L. Mordell, M.E.I.C., Director of the Laboratory. In a small room designated on the programme as "the library" but which up to now has not a single book in it, the guests were "briefed" by Professor Mordell and Dr. O. M. Solandt, Aff.-E.I.C. Chairman of the Defence Research Board.

Among the guests were officers of several industrial organizations, the Defence Research Board, the Department of Mines and Technical Surveys, the Department of National Defence, the United States diplomatic corps and army, transportation companies, and the press.

The first trip around the lab found all the rigs idle. It was arranged that way so explanation of each unit could be given. The logic of this became apparent on the second trip at which time the rigs were all in action. Each one developed enough noise to render conversation impossible, even in the most remote corner. As a matter of fact there was much more to hear than there was to see. Today's machines and process equipment are nearly always inside housings that hide from the casual eye every sign of motion, or the motion itself is so rapid that the eye believes everything is standing still. Certainly these are the conditions at the gas dynamics lab.

The laboratory has three functions: 1—To train engineers and scientists in advanced forms of mechanical engineering both in research and development; 2—To do fundamental research related to gas dynamics and gas turbines; 3—To

Gas dynamics research. In one of the smaller laboratories, a group is interested in the operation of one of the several rigs. Left to right: Dean J. J. O'Neill, Prof. C. A. Robb, unidentified, Dr. O. M. Solandt, Dr. J. J. Green, Prof. D. L. Mordell and G. N. Adams.

build or acquire suitable facilities for the development of work of national importance.

The Backers

The building, and funds necessary for its conversion, and the provision of basic equipment and facilities were made available by the Board of Governors of McGill University, and by Imperial Oil Limited, Shell Oil Company of Canada Limited, and the Ford Motor Company of Canada Limited. Funds for specialized equipment, and its operation, including salaries, have been provided by grants from the Defence Research Board. More recently, a contract with the Department of Mines for a development job has provided most useful additional test facilities and instrumentation.

Training

The laboratory offers unusual opportunities to students for advanced study. To date nine have graduated with a M. Eng. degree. Next year it is expected there will be eight more. There is now enrolled the first student working for his Ph.D. in mechanical engineering. It is hoped that industry may supply funds for scholarships so that top grade men may be attracted to help with the lab's own special research work and with the training of scholars.

The Work

The work for the students is divided into two classes:—a—the construction of equipment for a particular project and for the permanent use of the lab, and—b—problems that fit into the basic plans. Under "a", the problems so far have included: 1—Effect of fuel composition on carbon deposition in small combustion systems; 2—Performance of high speed air ejectors; 3—Effect of axial pressure gradient upon boundary layer thickness; 4—Performance of a jet propulsion engine and research on methods of boosting the thrust. In addition, there has been constructed apparatus for complete tests on turbines, compressors, and combustion chambers.

Under the basic plans the first problem is related to combustion and the aim is to carry out the fundamental studies pertaining to the performance of combustion systems such as are used in gas turbines or ramjets. The major project is a study of the spontaneous ignition of liquid hydrocarbons in a hot gas stream. During the past year a considerable amount of useful running has been carried out, obtaining results on the effect of turbulence on delay times which are new. Ancillary to this has been a programme of development of means of temperature measurement, which are now ready to be applied to the rig to increase its usefulness. The mechanism of stability has been studied and rigs built to verify some of the predictions. Some partial confirmation was obtained and the work is continuing with more refinement. This programme was discussed during the meetings of the Commonwealth Advisory Aeronautical Research Committee in Ottawa last year, and received favourable comment.

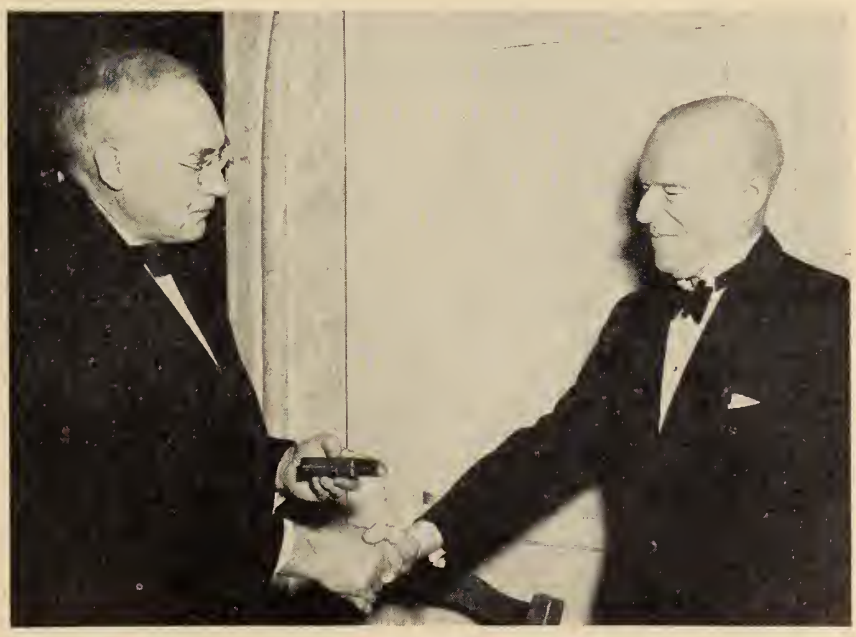
The second basic problem is the flow problem in compressors. A start has been made with a low speed cascade tunnel which also serves an educational purpose, also a rig for work on axial compressors is being built, making use of a research unit constructed by A. V. Roe.

Development

Considerable work has been done at the request of the R.C.A.F. on the effect of fuel properties on carbon deposition in full scale combustion systems and on the development of a coal burning gas turbine for the Mines Department. The coal burning turbine is of course not of immediate defence interest, but the complete utilization of fuel resources is very much a national interest. The facilities erected for testing it are of course suitable for testing other kinds of engines if the need arises.

The Faculty of Engineering at McGill may well be pleased with the work already done at Ste. Anne's. This "off the campus" activity is unique and the successes of the past are but stepping stones to even greater attainments in the future. In the short space of a little more than two and a half years, Professor Mordell has worked wonders, both with men and materials. His work has brought substantial credit to the McGill Faculty of Engineering and in particular to the Department of Mechanical Engineering, of which Professor C. A. Robb, M.E.I.C., is head.

Presentation of Julian C. Smith Medal



On the occasion of the recent visit of President Macnab (left) to the Ottawa Branch, he presented to Lieut.-Commander C. P. Edwards (right) the Julian C. Smith Medal of the Institute. Commander Edwards was not present at the Annual Meeting in May 1951, when the award was to be made.

News of Other Societies

The second regional conference of the Chemical Engineering Division of **The Chemical Institute of Canada** (18 Rideau St., Ottawa 2, Ont.) will be held in Hamilton, Ont., March 3-4, 1952. Technical sessions and luncheons will be at the Royal Connaught Hotel.

The first regular meeting of the **Chemical Engineers Club** of A.I.Ch.E. Members in Montreal was held on November 28 at the Physical Science Building of McGill University. The subject of the meeting was "Instrumentation".

The speaker was Mr. H. F. Hunt, Peacock Bros. Ltd., who discussed the development of modern instrumentation, leading to automatic controls in chemical processes.

The election of William I. Burt, vice-president—manufacturing, of the B. F. Goodrich Chemical Company, Cleveland, Ohio, as president of the **American Institute of Chemical Engineers** for 1952, was announced in December by the council of A.I.Ch.E.

The schedule of meetings of the **American Society for Testing Materials** (1916 Race St., Philadelphia) includes: the A.S.T.M. spring meeting and committee week, at the Hotel Statler, Cleveland, Ohio, March 3-7, 1952; and the fiftieth anniversary annual meeting, at the Hotels Statler and New Yorker, June 23-27, 1952.

Wellwood E. Beall, vice-president—engineering and sales, of Boeing Airplane Company, has been elected president of the **Institute of Aeronautical Sciences** for 1952.

The **American Institute of Mining and Metallurgical Engineers** (29 West 39th St., New York 18) have announced that the annual meeting will be held February 18-21, 1952, at the Hotel Statler, New York City, N.Y.

The Fifth National Plastics Exposition, sponsored by the **Society of the Plastics Industry Inc.** (67 West 44th St., New York 18) will take place at Convention Hall, Philadelphia, Pa., March 11, 12, 13, 14, 1952.

The **Institution of Electrical Engineers** (Savoy Place, London W.C. 2, England) has available details of the programme of the Television Convention, 1952, which is being arranged by the Committee of the I.E.E. Radio Section, for April 28 to May 3, 1952, to discuss "The British Contribution to Television".

Sixty to eighty papers will be contributed, and advance copies will be available during April, 1952. Sessions will be devoted to: programme origination, point-to-point transmission, broadcasting sections, propagation, receiving equipment, non-broadcasting applications, and system aspects.

Elections and Transfers

At the meeting of Council held at the Lord Beaverbrook Hotel, Fredericton, N.B., on Saturday, December 8th, 1951, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

H. J. Barratt, *Vancouver.*
P. L. Brisson, *Quebec.*
P. Chasin, *Fort Erie.*
R. J. Donald, *Montreal.*
M. E. Gooding, *Arvida.*
H. W. Krusche, *Turner Valley.*
G. F. MacKelvie, *Winnipeg.*
H. H. Poulton, *Toronto.*
W. D. Sheldon, *Galt.*
R. Simard, *Sarnia.*
N. Strauss, *St. John's.*
W. Tannenzapf, *Montreal.*

Juniors:

T. J. Briggs, *Fort Erie.*
D. E. Hazelton, *Hamilton.*
D. C. Hubble, *Kingston.*
K. W. Kaye, *Galt.*
C. H. Killoran, *Niagara Falls.*
D. Laschuk, *Yellowknife.*
S. S. Lazier, *Toronto.*
A. T. Ross, *Montreal.*
J. W. Strzelecki, *Montreal.*

Transferred from the class of Junior to that of Member:

A. R. Bader, *Milwaukee.*
R. T. Bailey, *Welland.*
W. T. Balderson, *Montreal.*
M. C. Caron, *French W. Africa.*
J. W. Church, *Toronto.*
B. B. Cox, *Kingston.*
B. B. Denyes, *Ottawa.*
J. A. Deptford, *New Westminster.*
J. G. Dickinson, *Winnipeg.*
M. E. Gosset, *Montreal.*
C. H. Hussey, *Montreal.*
D. M. Lappi, *Montreal.*
C. D. MacDougall, *Moncton.*
J. B. Ross, *Montreal.*
E. B. Sleigh, *Vancouver.*
J. L. Tiedje, *Sarnia.*

Transferred from the class of Student to that of Junior:

A. C. Eliadis, *Montreal.*

The following Students were admitted:

B. M. E. Boytzun
R. G. A. Brearley
J. R. Buttle
R. S. Crittenden
A. G. Frame
H. B. Fowler
L. J. Goodin
W. C. Herrett
J. G. Lyman
R. S. MacKay
J. M. MacLeod
E. C. MacNearney
H. J. MacNeil
P. van der Meyden
G. W. Miller
T. L. Myles
J. C. Newby
H. Newall
R. N. Scott
R. F. Staples

Applications Through Associations

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

SASKATCHEWAN

Member:

C. D. Smith.

Students:

P. W. Boesch.
W. E. Buchan.
K. R. Craig.
G. T. Fenwick.
S. S. Gray.
D. G. Grenkie.
F. A. Keetley.
J. N. Learmonth.
K. J. MacRae.
W. J. Martenson.
J. F. Metheral.
W. J. Minish.
C. C. Nicholson.
R. Oancia.
M. B. Wall.

Junior to Member:

R. H. Ball.
H. Fleming.
N. M. Hoffman.
R. C. Mordan.

Student to Junior:

L. H. Sproule.

MANITOBA

Members:

D. G. Farn.
L. Millidge.
E. H. Price.
S. Stoller.

NEW BRUNSWICK

Junior to Member:

G. D. Lyon.
P. G. Robinson.

NOVA SCOTIA

Members:

C. V. Campbell
D. MacAskill.
W. A. MacIsaac.
N. M. McFetridge.

Junior to Member:

A. M. Dechman.
E. W. Elliott.
D. E. Hebb.
C. M. McGibbon.
L. B. Murphy.

QUEBEC

Members:

C. E. Allan.
C. B. Gale.
M. Huepeden.

Expansion in the Maritimes

Early in December the president naugurated two new branches—one t Fredericton, N.B. and one at Charlottetown, to be known as the Prince Edward Island Branch.

The Fredericton ceremony took place on Friday, December 7th. It was quite an affair, with about 135 people present. The first item on the programme was a reception at the Beaverbrook Hotel. This was followed by a splendid dinner—also at the hotel, and then the presentation of the charter.

The whole programme was under the direction of D. J. Brewer, provisional chairman of the branch, and he was ably supported by the members of his executive committee. Every detail of the programme had been worked out carefully as was amply demonstrated by the smoothness of the performance. Such fine arrangements augur well for the future of the branch.

There were many guests and representatives from other branches. Dr. Truman, President of the University of New Brunswick and Mrs. Truman were present, also Dr. E. O. Turner, vice-president of the Institute for the Maritimes and Mrs. Turner. Branch representatives were D. O. Turnbull who presented the new branch with an Institute banner on behalf of the Saint John Branch, J. B. Stirling, vice-president and G. A. Gaherty, treasurer of the Institute from Montreal, E. M. Nason, chairman, and R. L. Parsons, councillor of the Moncton Branch and Mrs. Nason, W. K. Sharpe, provisional chairman of the Prince Edward Island Branch and Mrs. Sharpe.

Following the dinner there was a dance in the ballroom of the hotel. The presence of a great many students, who participated in this portion of the programme only, added considerable importance and colour to the occasion. The hall was gaily decorated for the occasion by the students (and was "undecorated" by them also before the night was over).

Seldom has a branch been inaugurated with more enthusiasm. If meetings of this kind become standard practice in the area, there is indeed a distinguished future in store for the branch.

Orphans' Party

Some sort of a new record was made at Bathurst on Monday, December 10th. There is no branch there and yet a meeting organized by the Moncton Branch turned out 99 people.

The hospitality for which the Maritimes are famous was evident at every turn. After the wonderful meeting at Fredericton the presidential party did not expect any more highlights, but everything continued to boom throughout the journey. From Fredericton the party motored to Bathurst arriving on the wings of a real snowstorm. The skilful driving of John Young of Saint John, who had so kindly provided

Bathurst

Upper: Head table, left to right: W. C. Baggs, Gordon Chalmers, Mrs. Nason, President Macnab; E. M. Nason, chairman of the Branch; R. L. Weldon; Mrs. Chalmers; L. Austin Wright; and Mrs. Baggs.

Lower: The overflow meeting, at which a good time was had by all.

the transportation brought the party through without mishap.

A feature of the meeting here was a reception provided by R. L. Weldon, president of the Bathurst Power and Paper Co. Ltd., and a member of the Institute finance committee. This was held prior to the dinner, at Mr. Weldon's commodious home. It formed a wonderful background for the meeting, permitting ladies and gentlemen who had come from many nearby centres to get to know each other well in advance of the formal (?) meeting. Mr. Weldon's kindness was appreciated greatly by everyone and in particular the officers of the Moncton Branch.

The meeting was held at the Gloucester Hotel where the facilities were taxed to the limit. E. M. Nason, chairman of the branch, presided and the list of speakers included the president, Mr. Weldon, and the general secretary.

The occasion was a happy one. Some entertainment of a black face routine was given by H. J. Williamson of the Moncton executive in his own inimitable manner, and the audience not only joined in this but carried out several choral efforts of their own.

Since Dr. Grant, the field secretary, discovered the new resident "orphan" groups there have been many meetings away from branch headquarters, but it is doubtful if ever there was as large or as enthusiastic a one as this. The actual recorded attendance was 99 but the advance reservations totalled 120. Bad weather blocked some roads and engineers from places such as Campbellton could not get through. The officers of the Moncton Branch deserve great credit for their progressiveness and aggressiveness which made this outstanding event possible.

New Branch at Prince Edward Island

The 37th branch of the Institute was sent off on its useful career, when the president presented the charter on Wednesday, December 12th, at the Charlottetown Hotel, to the Prince Edward Island Branch. The provisional chairman, W. K. Sharpe, presided, and he had as guests at head table Lieut.-Governor the Honorable T. William L. Prowse, the Premier's representative, the Honorable A. W. Matheson and His Worship Mayor Fraser and their wives. There were about 65 present.

The Lieut.-Governor welcomed the president and expressed his best wishes for the success of the new branch. The Honorable Mr. Matheson explained that as the Premier had been called away, he had been delegated to represent him and to greet the new branch. His Worship the Mayor had a special duty to perform as well as to wish the branch a successful and useful career on behalf of the Council. Because of his knowledge of and contacts with the president and his family, he had been asked to do the introduction of the president, which he then proceeded to do with great effect.

Playing on the words of the president when he had referred to the Island as being the last province to come into the Institute the chairman presented Dr. Macnab with an Indian headdress and referred to him as the "big chief" who had come to this "outpost of Empire" to bring engineering recognition to them. The president donned the feathers and did his best to look the part—much to everyone's delight (see photograph).

Charlottetown

Above, left: Left to right, Mrs. Fraser, the Hon. A. W. Matheson, Mrs. Sharpe, The Hon. T. W. L. Prowse; W. K. Sharpe, chairman; President Macnab, Mrs. Prowse, His Worship Mayor Fraser, and Mrs. Matheson.

•

Above right: The president presents the charter to provisional chairman W. K. Sharpe.

•

Left: Big Chief Macnab, and other Indians. From left to right, Mrs. W. K. Sharpe, Mayor Fraser, the president, Mrs. Fraser and Mrs. J. R. Kaye.

Fredericton

Head table guests, left to right, from top to bottom:

W. K. Sharpe, chairman P.E.I. Branch; George Cassidy, deputy minister of the Department of Public Works; Mrs. E. M. Nason.

D. T. Cochrane, vice-chairman, N.B. Electric Power Commission; Mrs. D. O. Turnbull; Dr. A. W. Trueman, president of University of New Brunswick; Mrs. E. O. Turner.

Mrs. Brewer, President Macnab, D. J. Brewer, chairman; J. B. Stirling, vice-president of the Institute; Mrs. Trueman.

Mrs. Trueman, Dean E. O. Turner, Mrs. Cochrane, D. O. Turnbull, Saint John, N.B.

Mrs. Cassidy; G. A. Gaherty, treasurer, E.I.C.; Mrs. W. K. Sharpe, and E. M. Nason.

Below. The president presents the Institute prize to Stig Harvor.

Proposed Memorial to the late Major-General W. B. Lindsay

At the 1951 annual meeting of the Military Engineers' Association of Canada, it was proposed by a number of those who served in the Canadian Engineers in the First World War that the late Major-General W. B. Lindsay, C.B., C.M.G., who, from March, 1916, until the end of that war was the chief engineer of the first Canadian Corps ever formed, be commemorated by a trophy, to be known as the Lindsay Memorial Trophy, for competition among Reserve Force units of the R.C.E. It was suggested that it would be most appropriate if such a Trophy were provided by personnel of all ranks who served in the Canadian Engineers in the war.

Accordingly, an appeal is being made to all ex-R.C.E. personnel for contributions to make possible the establishment of the trophy. The fund will be administered by a committee composed of Major-General G. R. Turner, Major-General Howard Kennedy, and Brigadier J. L. Melville, and contributions should be sent, by cheque or money order payable to the Lindsay Memorial Fund, to Lieut.-Colonel E. M. Medlen, 227 Third Avenue, Ottawa, treasurer of the fund.

It is hoped that it will be possible for the first award of the trophy to be made at the annual meeting of the Military Engineers' Association of Canada in October, 1952, but in order to ensure this it is essential that all contributions be received by February 15th.

Many of our members served with the Canadian Engineers in the First World War, and we are sure they will be interested to learn — if they have not already been informed — of this proposal to honour their old chief.

The Athlone Fellowships

1. The Athlone Fellowships are awarded annually by His Majesty's Government in the United Kingdom to enable Canadian engineering graduates to take post-graduate training in the United Kingdom.

2. The Fellowships fall into two groups:

A. 28 available for graduates on completion of a bachelor's or higher degree.

B. 10 available for engineers who have already spent some time in industry.

3. The Fellowships provide for a period of 2 years in the United Kingdom and are awarded on the understanding that their holders afterwards return to Canada to follow their careers. They are available for any among the following options but the preference of the awarding authorities is for courses involving works experience.

(1) Works training in one or more approved industrial organizations.

(2) Post graduate studies in a United Kingdom university or college or research establishment.

(3) A combination of (1) and (2).

(4) Research in a United Kingdom university leading to the degrees of M.Sc. or Ph.D. Candidates cannot be considered for this option unless their university recommends them as suitable for research work, and has obtained from a United Kingdom institution an assurance that they will be acceptable if awarded a Fellowship.

4. Candidates receive advice on their proposed course of training from the Athlone Fellowship Committee in the United Kingdom, representative of industry, the Universities, and the United Kingdom Government, and arrangements for their reception and placing are supervised by this body. The Committee likewise concerns itself with the welfare and progress of the Fellows throughout their stay in the United Kingdom.

5. To ensure as wide a distribution as possible of the 28 Fellowships in Group A, selection is made from all Canadian universities having engineering faculties, in accordance with the following table.

	Fellowships
Nova Scotia Technical College, Halifax, N.S.	2
University of New Brunswick, Fredericton, N.B.	1
Laval University, Quebec, Que.	2
McGill University, Montreal, Que.	3
Ecole Polytechnique, Montreal, Que.	2
Queen's University, Kingston, Ont.	3
University of Toronto, Toronto, Ont.	5
University of Manitoba, Winnipeg, Man.	2
University of Saskatchewan, Saskatoon, Sask.	2
University of Alberta, Edmonton, Alta.	2
University of British Columbia, Vancouver, B.C.	4

This quota is reviewed from time to time, to relate it to the numbers graduating at the several universities.

6. Eligibility

(1) The candidate should be a Canadian citizen or a British subject normally resident in Canada, holding or about to obtain a degree awarded by one of the Universities listed above, on the successful completion of a course of study in any branch of engineering. A degree is not an indispensable requirement for candidates in Group B possessing alternative qualifications.

(2) The candidate should not normally have passed his 27th birthday by October 1st in the year of selection for a Fellowship.

7. Value of the Fellowship

The amount covers:—

(i) Cost of travel from home to the United Kingdom and return, and within the United Kingdom as may be approved.

(ii) Cost of approved university or college tuition and other fees.

(iii) Maintenance allowance at the rate of £6 10s. per week, payable quarterly in advance. This is not subject to Income Tax, National Health or National Insurance contributions.

8. Basis of Selection

In selecting candidates regard will be had to their academic and technical competence, physical fitness and personal qualities.

9. Method of Application

Application forms may be had from the Registrars of the Universities enumerated in para. 5. Candidates should complete and submit these, together with a recent photograph of themselves, to the Registrar of the University of which they are or will become graduates. A Group B candidate who is not a University graduate should apply to the Registrar at the University in para. 5 nearest to his home. *The closing date for applications is 15th January.*

10. References

References are taken up by Registrars, on receipt of completed application forms, to be available when the selection of Fellows is made.

11. Selection Procedure

A local Selection Board is convened during the month of February by the Dean of Engineering in each University.

The local Selection Board at each University makes the final selection from among that University's candidates under Group A, and successful candidates are then provisionally notified. This is officially confirmed, subject only to successful graduation and medical fitness, when the selection for the whole of Canada has been completed. The Selection Board may also recommend reserve candidates.

The local Selection Board interviews those candidates for Group B Fellowships for whom the University is the most convenient centre. When an applicant in industry wishes to be interviewed at a university other than that at which he graduated, he should explain this to the Registrar of his own University when he submits his application.

The final selection of Group B Fellows is made by persons appointed by the United King lom High Commissioner, one or more of whom will be a Chairman of one of the local Selection Boards. All candidates are advised of the outcome without further delay.

12. Reserve Candidates

If the number of graduates recommended by the Selection Board at a university is less than the number of Fellowships offered to that university, or if a selected graduate does not for any reason take up his Fellowship, or if less than the full number of 10 candidates from industry with the necessary qualifications are forthcoming, additional names may be selected by the United Kingdom High Commissioner from among those in reserve, always having regard, as far as possible, to the quota set out in para. 5.

13. Procedure after Selection

The results of final examination are made known to the United Kingdom High Commissioner as soon as they become available. Travel arrangements are then finalised by him and in normal cases sea passages during the month of September are provided.

OFFICE OF THE HIGH COMMISSIONER
FOR THE UNITED KINGDOM
Ottawa, Ontario
October, 1951

Personals

News of the Personal Activities of Members of the Institute

Ira P. Macnab, M.E.I.C., president of the Engineering Institute of Canada, and general manager of the Public Service Commission of Halifax has been appointed a director of the Eastern Trust Company.

J. G. Notman, M.E.I.C., of Montreal, has been elected a director and senior vice-president of Electric Boat Company, New York. Mr. Notman is executive vice-president, general manager and a director of the company's aircraft manufacturing subsidiary, Canadair Limited.

Professor R. W. Angus, HON. M.E.I.C., at the annual meeting of the American Society of Mechanical Engineers in Atlantic City in November last, was awarded a 50-year pin. Professor emeritus of mechanical engineering at the University of Toronto, Professor Angus joined the Society in 1901, was elected Fellow in 1936 and an honorary member in 1940. He served as vice-president from 1924 to 1926.

Dr. A. G. Christie, M.E.I.C., has been appointed an honorary member of the Japan Society of Mechanical Engineers. This outstanding honour was bestowed upon Dr. Christie in recognition of his work during the summer of last year on the Engineering Education Mission to Japan.

Lt.-Commander C. P. Edwards, C.M.G., M.E.I.C., has retired as deputy minister of transport of Canada.

Born at Dodleston, Chester, England, Commander Edwards was educated at Arnold Technical School, Chester, England and at Marconi Wireless Telegraph Company's Training Schools for engineers at Chelmsford, England. In 1904, he was junior technical assistant on the experimental staff of Marconi Wireless Telegraph Company in England. He came to Canada in 1904 to supervise the construction of several radio stations. In 1909, he was made director of radio for the Department of Marine, assuming charge of all wireless and radio activities in Canada. In 1941, Commander Edwards was appointed deputy minister of the Department of Transport at Ottawa.

Commander Edwards has been the Dominion's representative at practically all the International and North American radio conferences held since 1912. He was chairman of the committee which drew up regulations for the compulsory equipment of ships with radio at the International Conference for the safety of life at sea, in 1929.

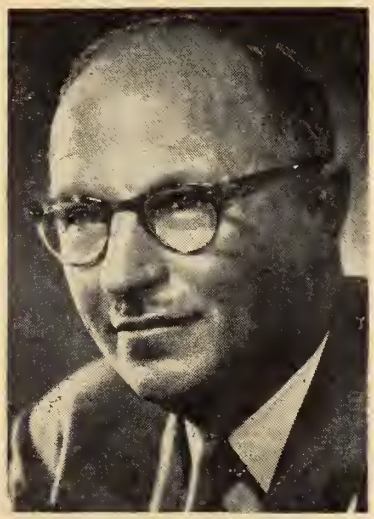
T. E. Price, M.E.I.C., retired from the Canadian Pacific Railway Company in November.

He joined the C.P.R. at Vancouver, B.C., in 1906 and in World War I. he served overseas with the Canadian Railway Troops, in France. On returning to Canada in 1919, he resumed the position of divisional engineer of C.P.R. at Vancouver. In 1944, he was appointed maintenance of way engineer, Pacific and Prairie regions, at Winnipeg, Manitoba, where he remained until his retirement.

He graduated in civil engineering from McGill University in 1910.

O. W. Titus, M.E.I.C., has been appointed vice-president of the Canada Wire and Cable Company, Limited, Leaside.

Mr. Titus continues as general manager of the operations of the Company, which include factories at Leaside, Ont.; Montreal East, Que.; and Vancouver, B.C.; as well as sales offices from coast to coast.



O. W. Titus, M.E.I.C.

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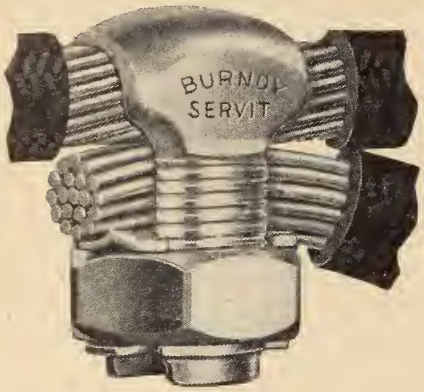

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W. R. Manock, M.E.I.C., president of the Horton Steel Works Limited, Fort Erie, Ontario, has retired.

Mr. Manock is a past vice-president of the Institute, and represented the Niagara Peninsula Branch on the Council from 1938 to 1942.

He became associated with Chicago Bridge and Iron Company in Chicago in 1912, transferring to the Canadian subsidiary, Horton Steel Works in 1924,

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

as manager of operations. His appointment as president of Horton Steel Works Limited took place in 1944.

He graduated from the University of Illinois in civil engineering in 1910.

J. W. Sanger, M.E.I.C., has retired as general manager of the Winnipeg Hydro Electric System.

Mr. Sanger joined the Winnipeg System in 1912 as a distribution superintendent. Other appointments followed, and his appointment as general manager was in 1944.

Mr. Sanger is vice-president of the

J. W. Sanger, M.E.I.C.

Engineering Institute for the Western Provinces. He is a past chairman and past councillor of the Winnipeg Branch of the Institute. He is a past president also of the Association of Professional Engineers of Manitoba.

He is a past vice-chairman of the Industrial Development Board of Manitoba and has served on the executive of the Winnipeg Board of Trade. He was appointed in 1951 a member of the Manitoba Hydro Electric Board.

H. L. Briggs, M.E.I.C., has been appointed general manager of the Winnipeg Hydro Electric System. Mr. Briggs joined the staff of the Winnipeg Hydro as relay engineer in 1928, direct from the University of Manitoba where he graduated with highest honours, receiving the University Gold Medal in electrical engineering. While he was chief engineer from 1944 to 1948, the second half of the Slave Falls power plant was

H. L. Briggs, M.E.I.C.

constructed and the four generating units were installed. Since 1948, he has held the position of assistant general manager.

He is past chairman of the Winnipeg Branch of the Engineering Institute and also a member of the American Institute of Electrical Engineers, the Winnipeg Chamber of Commerce, and a director of the Industrial Development Board of Greater Winnipeg.

H. R. Younger, M.E.I.C., has retired from his position as district engineer with the Canadian Pacific Railway Company at Calgary, Alberta. A graduate in civil engineering from McGill University in 1910, Mr. Younger was first employed by the Canadian Pacific during vacations, and upon graduation permanently joined its staff. He spent four years as instrumentman on construction at the Kootenay Central Branch. He has been division engineer at Nelson, B.C. and superintendent of the Kettle Valley Division located at Penticton, B.C., being appointed district engineer at Calgary in 1941.

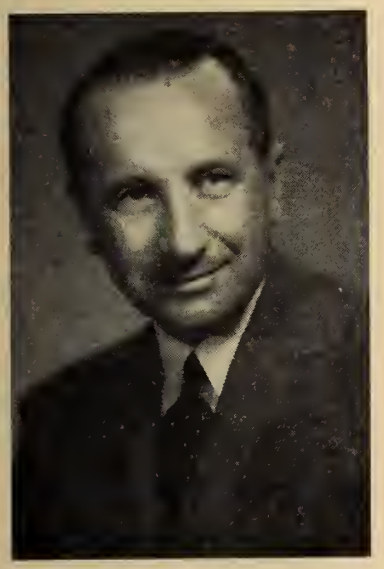
Mr. Younger was chairman of the Calgary Branch of the Institute in 1946.

G. M. Minard, M.E.I.C., plant manager at Kapuskasing, Ont., has been named vice-president of Spruce Falls Power and Paper Company, Limited.

Mr. Minard became associated with the Company soon after graduating in 1928 from Queen's University, Kingston. He was superintendent of the technical department before going on leave to the R.C.A.F. in 1940. On his return to the Company's service in 1946 he was appointed assistant to the managing director. In 1949 he was appointed mill manager.

W. A. Osbourne, M.E.I.C., of Galt, Ont., has been elected president of Babcock-Wilcox and Goldie-McCulloch Ltd. Previously, he was vice-president and general manager of the Company.

He joined Babcock-Wilcox & Goldie-McCulloch as a student engineer in



W. A. Osbourne, M.E.I.C.

1924 after graduating from University of Toronto. He became a sales engineer for the Company a year later and received subsequent appointments as sales manager, 1934; works manager, 1940; and general manager, 1945.

Mr. Osbourne has served on the advisory council of the Canadian Welding Bureau.

R. S. Eadie, M.E.I.C., has been appointed vice-president and manager of the Eastern Division of the Dominion Bridge Company Limited.

Previously, he was chief engineer of this division. Mr. Eadie joined the company as a designer in 1924, after lecturing for four years in the Faculty of Applied Science of McGill University. He had received the degree of B.A.Sc. in civil engineering in 1920 from McGill University, and in 1922 the degree of M.Sc.

With Dominion Bridge he was appointed designing engineer in 1935; assistant chief engineer in 1937; and chief engineer of the Eastern Division in 1944.

Mr. Eadie was active for a number of years on several technical committees of the Canadian Standards Association; is a member of the Corporation of Professional Engineers of the Province of Quebec.

G. P. Wilbur, M.E.I.C., has been named vice-president and manager of the Ontario Division of the Dominion Bridge

G. P. Wilbur, M.E.I.C.

Company Limited. Previously, he was manager of this division.

He joined Dominion Bridge Company in 1913 as a checker of structural drawings at Toronto. He was appointed chief draughtsman of the Ontario Division in 1922. This was followed by a period as contracting engineer and sales manager, after which he was appointed manager of the Ontario Division in 1942.

He is vice-president of the Sault Structural Steel Co. Ltd., and a director of Dominion Engineering Works Ltd.

Mr. Wilbur is a past president of the Canadian Institute of Steel Construction; a past chairman of the Toronto Branch of the Canadian Manufacturers Association.

A. S. Gentles, M.E.I.C., has been appointed vice-president and manager of the

R. S. Eadie, M.E.I.C.

A. S. Gentles, M.E.I.C.

Aerial Survey

ACCESS TO THE SEA

Walled off from the Pacific Ocean by the western cordilleras of the Andes, the city of Bogotá, stately capital of Colombia, stands 8,700 feet above sea level on a mountain-enclosed plateau. Bogotá's natural access to the sea lies through the heavily-jungled tropical valley of the Magdalena River, which spills its brown waters into the Caribbean 600 miles to the north. A rail line reaches out from Bogotá a short distance down the Magdalena valley, but terminates a good 200 miles from the head of year-round navigation on the river.

In 1950, when the Government of Colombia decided to build a railway bridging this 200-mile gap, the tough task of locating the new rail route was assigned to a New York firm of consulting engineers, Lockwood, Kessler & Bartlett, Inc. Internationally experienced in such projects, Lockwood, Kessler & Bartlett elected to base their location on air survey mapping and contracted for the new techniques and instruments developed by a Canadian firm, The Photographic Survey Corporation, Limited, of Toronto.

The Andes: A wall on the west

Obtaining a grid of known ground elevations to "control" the topographic mapping of this difficult terrain would have been a slow and arduous operation on foot. By air it was a quick and relatively easy job.

In January, 1951, flying at 20,000 feet, a PSC aircraft obtained vertical air photography of selected areas; then, the same aircraft flying at a lower altitude obtained a network of ground profiles, recorded by the PSC Airborne Profile Recorder. (APR), a Canadian electronics development.

Photography and the APR profiles were fed to the engineers in New York for co-ordination with additional ground information to produce topographic maps of the area. The final product, obtained within a few months (and now being verified by ground engineers), provided the reconnaissance information on which location was selected and grades and quantities studied.

It has been conservatively estimated that the Airborne Profile Recorder can obtain in a single day topographical information that would require at least six weeks' hard work by ground surveyors.

If you desire information on the Airborne Profile Recorder, photogrammetric mapping, forest inventory, aeromagnetic surveying, or any aspect of surveying from the air, write on company letterhead, to:

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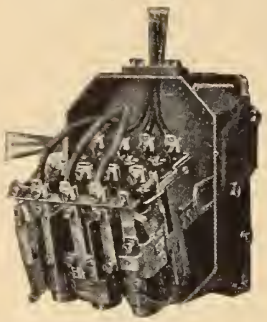

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Pacific Division of the Dominion Bridge Company Limited. Previously he was manager of this division.

After graduating from McGill University, he became field engineer for the Mines Branch, Department of Mines, Maritime Provinces, then resident engineer of bridges, Halifax Ocean Terminals. Subsequent appointments were as sales engineer, chief engineer and assistant general manager, Canadian Northwest Steel Company, Vancouver, and sales manager of Vulcan Iron Works, Vancouver. He was also for a period, in business on his own account in that city.

He was appointed manager of Dominion Bridge Company's Pacific Division in 1927.

Mr. Gentles is a member and past-president of the Association of Professional Engineers of British Columbia.

P. E. Kirkpatrick, M.E.I.C., of the Calgary Power Company, Lethbridge, has been elected the chairman of the Lethbridge Branch of the Institute.

Mr. Kirkpatrick was born at Canton, Ohio. He studied at Massachusetts Institute of Technology and at the U.S. Government Electrical School in Brooklyn, N.Y. He was with the 101st Signal Battalion in 1917 to 1919, after which he was in Edmonton, Alberta for three years, operating the Edmonton city power house. He did electrical contracting work in Calgary and Southern Alberta, from 1926 to 1930, and joined the Calgary Power Company then as an operating engineer. He was in Regina from 1936 to 1942, associated with the Montreal Engineering Company. He went to Lethbridge for the Calgary Power Company in 1942.

S. H. de Jong, M.E.I.C.

S. H. de Jong, M.E.I.C., associate professor, University of British Columbia, is chairman of the Vancouver Branch of the Institute.

Mr. de Jong is from East Kildonan, Manitoba. He graduated from the University of Manitoba in 1931 with a degree in civil engineering and for three sessions was employed as a demonstrator at the University. In 1935, he was a draughtsman and office manager with Fort Garry Motor Body and Paint Works Limited at Winnipeg and, in 1936, he was a night school instructor with the city of Winnipeg School Board and Department of Education of Manitoba. In 1937, he went to Ottawa as compiler in the Topographic and Air Surveys Branch of the Department of Mines and Resources.

He was a demonstrator in the department of civil engineering of University of Toronto for five years before joining the staff of the University of British Columbia in 1945.

C. J. Timleck, M.E.I.C., previously manager at Winnipeg, for Canadian Ingersoll-Rand Company Limited, has been

C. J. Timleck, M.E.I.C.

appointed manager of the Toronto Branch of the Company.

Mr. Timleck joined Ingersoll-Rand at Phillipsburg, N.J., after graduating from University of British Columbia, in 1926. After working as sales engineer at various American branches, he returned to Canada and was later placed in charge of the Canadian Ingersoll-Rand office in Rouyn, Que.

From 1929 to 1934 Mr. Timleck was manager of the Contract Service Department in Montreal. He was transferred to Winnipeg as a sales engineer in 1934 covering Western Ontario, Manitoba and Saskatchewan and in 1939 was made manager of the Winnipeg Branch.

Mr. Timleck, a member of the Canadian Institute of Mining and Metallurgy, is a past chairman of the Winnipeg Branch of C.I.M., and a former vice-president of the Manitoba Chamber of Mines.

C. J. Tanner, M.E.I.C., is in Brazil, South America, with the Electro-Quimica Brasilerie. Mr. Tanner was previously assistant supervisor of Ore Plant No. 1 of the Aluminum Company of Canada Limited at Arvida, Quebec.

He joined the Aluminum Company in 1943. He was chairman of the Junior Section of the Saguenay Branch of the Institute in 1947.

. F. Ronalds, M.E.I.C., is construction nanager for the Anfo Steel Corporation Limited in Toronto, Ontario. He is at resent superintending the erection of everal buildings at Wainwright, Alberta, fter having completed a building for Canadian Chemical Company at Edmonton, Alberta.

Previously, Mr. Ronalds was project ngineer with the Ontario Hydro Elecric Power Commission at Toronto.

R. E. Stopps, M.E.I.C., has left Montreal o take a position as electrical engineer vith El-Met-Parts Limited at Dundas, Ontario.

Mr. Stopps graduated in electrical engineering from McGill University in 942. He worked in Montreal from 1946 vith Imperial Tobacco Company Limted.

I. T. Rose, M.E.I.C., of the Water Reources Division of the Department of Resources and Development is now in Ottawa, Ontario. Mr. Rose has been in Winnipeg with the department for a number of years.

R. Quintal, M.E.I.C., has joined the staff of the Montreal Transportation Commission.

He was an engineer in the Soils Department of the Highway Department of the Province of Quebec for several ears and later became soils specialist or the Department of Public Works of Montreal.

Mr. Quintal graduated in civil engineering from Ecole Polytechnique in 944.

Major J. W. McNaughton, M.E.I.C., is at Headquarters, Western Command, in Edmonton, Alberta. He received his romotion to the rank of Major recently and was appointed D.A.Q.M.G. at Edmonton.

Major McNaughton graduated in mechanical engineering from McGill University in 1941, and was on active service until 1946. He was with the Canadian Armament Research and Development Establishment as a design officer and chief draughtsman. Re-enlisting in the army in 1947 as a technical officer, he remained at C.A.R.D.E. as a design engineer with the rank of captain, until his transfer to Calgary in 1948.

P. E. Goodwin, M.E.I.C., has been appointed executive engineer with Vectron Incorporated at Waltham, Massachusetts. He will be in charge of all administration and engineering operations.

Mr. Goodwin came to Canada in 1948 and joined the General Engineering Company (Canada) Limited in Toronto. He became later the representative of Woods of Colchester Limited, an associate company of the General Electric Company.

G. R. Adams, M.E.I.C., has been appointed project manager with the Foundation Company of Canada, at Chalk River, Ontario. He has been with this company in Quebec, Manitoba and Ontario since 1940, most recently at Churchill, Manitoba.

J. B. C. Proctor, M.E.I.C., has been appointed works manager with the United States Gypsum Company in Philadelphia.

In 1938, Mr. Proctor graduated from the Nova Scotia Technical College. After service with the R.C.E.M.E. in the Directorate of Mechanical Engineering at Ottawa, Ontario, and in the Canadian Army overseas, he returned to Canada and worked for the Canadian Gypsum Company, Windsor, N.S., and in 1949 became works manager with the U.S. Gypsum Company at Midland, California.

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This meter enables small steam flows to be measured economically and has many advantages, being self-contained and entirely mechanical in operation.

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W. Murray, M.E.I.C., was recently appointed chief engineer project construction and assistant to the director of this division of the Rankin Company Limited, Industrial Engineers, in Montreal, being chiefly concerned with marine harbour works, industrial construction for the heavy industries and municipal engineering.

Mr. Murray graduated as a B.Sc. from Edinburgh University in 1926. He was until recently employed by Messrs. Gore and Storrie of Toronto.

J. S. MacNairn, M.E.I.C., who has been in Schwetzingen, Germany, a chemical engineer at the Pfaudler Works, has been transferred to Rochester, New York, to The Pfaudler Company. He became associated with the Research Laboratory of the Pfaudler Company at Rochester, N.Y., in 1948 after graduating from the University of Toronto, in ceramics.

C. R. T. Bingley, Jr.E.I.C., has returned to Canada from England where he was on a two year course with the General Electric Company, and is working in Toronto with the Service Department of Canadian Brazilian Services Limited.

Mr. Bingley graduated in electrical engineering from the University of Alberta in 1949.

R. H. Singleton, M.E.I.C., who was a research chemist with the Aluminium Laboratories Limited, at Arvida, Quebec, has joined the National Research Corporation in Cambridge, Massachusetts, U.S.A., in the capacity of project manager in connection with new methods of producing titanium metal.

Mr. Singleton graduated from the University of Saskatchewan in chemical engineering in 1942. He was the secretary-treasurer of the Junior Section of the Saguenay Branch of the Institute in 1950.

H. R. Young, Jr.E.I.C., has joined Margison, Babcock and Associates at Toronto, Ontario.

Mr. Young was previously with the Erection Department of the Dominion Bridge Company in Montreal, Quebec.

J. F. Dewson, Jr.E.I.C., is with The Capital Engineering Corporation, at Dillsburg, Pennsylvania.

He was previously resident highway engineer with the Department of Public Works, at Edmonton, Alberta, after graduating in civil engineering from the University of Saskatchewan in 1950.

G. G. Marshall, Jr.E.I.C., has joined the sales staff of the electrical department of Mumford-Medland Limited in Winnipeg. Previously, Mr. Marshall was with the engineering service division of the District Office of Canadian General Electric in Toronto.

He graduated in mechanical engineering from the University of Manitoba in 1949.

V. R. Cox, Jr.E.I.C., is with the Canadian National Railways construction department at Sherridon, Manitoba. Previously, he was an instrumentman for C.N.R. at Edmonton, Alberta. He graduated from the University of Alberta in 1949.

R. Martineau, JR.E.I.C., (Ecole Polytechnique, civil engineering, 1950) is with The Preload Company of Canada Limited in Montreal, Quebec.

T. Sakellariou, JR.E.I.C., is with Canadian Westinghouse in Hamilton, Ontario. Previously, he was with the Shell Oil Company (Canada) Ltd. at Montreal, Quebec.

Mr. Sakellariou graduated from McGill University in 1950.

R. W. Lockie, S.E.I.C., (University of British Columbia, mechanical engineering, 1950) is serving two years apprenticeship with the English Electric Company in Rugby, England, and will be returning to Canada in 1952.

E. H. Vogt, S.E.I.C., (University of Saskatchewan, 1951) is a draftsman with the Canadian Bridge Company Limited at Walkerville, Ontario.

S. Rokosh, S.E.I.C., is with Burns and Company Limited in Calgary, Alberta. Previously, he worked with Haddin, Davis and Brown Limited, consulting engineers at Calgary. Mr. Rokosh graduated in civil engineering from the University of Saskatchewan in 1951.

R. T. McLaughlin, S.E.I.C., (Queen's University, civil engineering, 1951) is at the California Institute of Technology in Pasadena, California.

T. B. Macaulay, S.E.I.C., (McGill University, mechanical engineering, 1951) is with A. V. Roe Canada Limited, at Nobel, Ontario.

R. C. Drinkwater, S.E.I.C., (University of Toronto, aeronautical engineering, 1951) has joined A. V. Roe Canada Limited at Brampton, Ontario, as an aircraft engineer. Mr. Drinkwater has been with Orillia Air Services Limited at Orillia since May, 1951, as a commercial pilot, flying instructor, aircraft mechanic and aeronautical engineer.

W. B. Dodd, S.E.I.C., (University of Toronto, mechanical engineering, 1951) is with Canadian Industries Limited at Brownsburg, Quebec.

R. G. Gowan, S.E.I.C., has joined C. D. Howe Company, Limited, consulting engineers in Montreal. Previously, he was with Building Products Limited in Montreal.

He graduated in mechanical engineering from Nova Scotia Technical College in 1950.

R. E. Pelkey, S.E.I.C., has been presented with the E.I.C. prize at the University of Saskatchewan. This prize is awarded to a student in the year prior to graduation, in Saskatchewan as in ten other Canadian Universities. The student is chosen for his college work and for his activities in the student engineering organization.

R. W. Smith, S.E.I.C., has left the Maritime-Newfoundland Agencies Limited at Halifax, Nova Scotia, and has joined The Combustion Engineering Corporation at Montreal, Que.

Visitors To Headquarters

J. S. Watt, M.E.I.C., Ottawa, Ont., November 5, 1951.

J. M. Gibson, M.E.I.C., Toronto, Ont., November 19, 1951.

T. C. Main, M.E.I.C., Edmonton, Alta., November 20, 1951.

E. M. Rensaa, M.E.I.C., Edmonton, Alta., November 20, 1951.

H. N. Burgess, Montreal, Que., December 1, 1951.

J. R. Dunbar, M.E.I.C., Hamilton, Ont., December 1, 1951.

F/L L. G. Pond, Bagotville, Que., December 3, 1951.

N. T. S. Winter, London, England, December 3, 1951.

A. Van den Brandeler, Paris, France, December 6, 1951.

J. D. Harvie, M.E.I.C., Halifax, N.S., December 10, 1951.

W. Waters, M.E.I.C., Prince Albert, Sask., December 13, 1951.

E. D. Fedryk, London, Ont., December 27, 1951.

A. Chunielenski, Montreal, Que., December 28, 1951.

Serg Nikolaiev, Montreal, Que., December 28, 1951.

Leon Frumkin, Montreal, Que., December 28, 1951.

V. Popov, Montreal, Que., December 28, 1951.

P. Kovacevich, Montreal, Que., December 28, 1951.

Ovid Tino, Montreal, Que., December 28, 1951.

Vladimir Horvath, Montreal, Que., December 28, 1951.

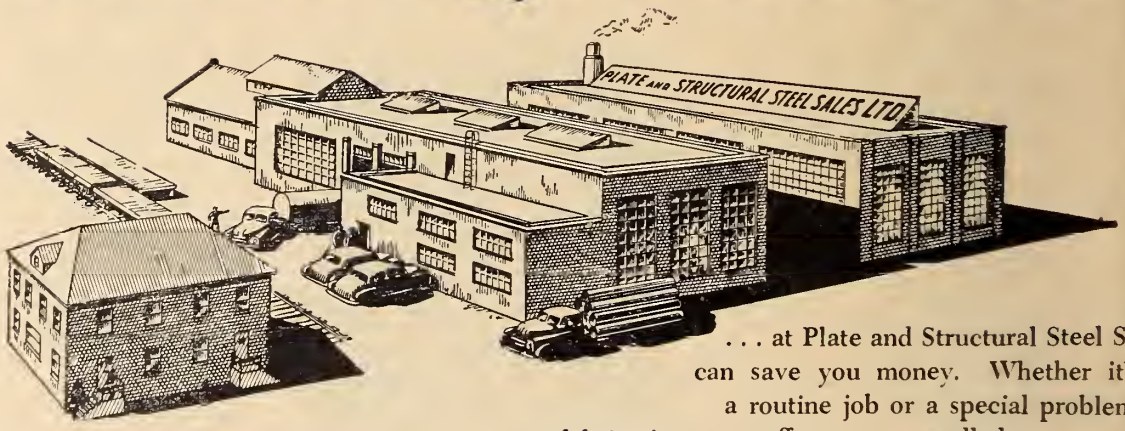
Dr. J. Utikal, Montreal, Que., December 28, 1951.

N. Tehartoriski, Montreal, Que., December 28, 1951.

S. J. Babkin, Montreal, Que., December 28, 1951.

O. Wuczkowski, Montreal, Que., December 28, 1951.

STEEL Quotations



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Obituaries

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

Charles W. Dill, M.E.I.C., died on November 24, 1951, in Vancouver.

Mr. Dill was born at Bracebridge, Ontario, in 1870, and until his death was one of the oldest surviving members of the Class of 1891 of S.P.S., University of Toronto, from which he graduated in civil engineering.

Upon graduation he worked in Canada and the United States in municipal engineering projects. He was appointed superintendent of the then suspension bridge at Niagara Falls, N.Y., in 1896, and assisted Mr. R. S. Buck, C.E., in the design and construction of one of two steel arch bridges at Niagara Falls. For the five years, 1901 to 1905 he was Assistant City Engineer of Toronto, and later entered private practice and became associated with others in the construction of the Trent Valley Canal and the large filtration plant on Toronto Island for the City of Toronto.

In 1912 he was appointed general manager of the National Paving Co., at Winnipeg, and in the years following, until the First World War forced the cessation of such activities in 1915, he superintended the construction of street pavements in the cities of Edmonton, Regina, Fort William and Port Arthur, and in the suburbs of Winnipeg. He was for five years chief engineer of the Province of Saskatchewan and in 1923 he returned to private contracting work, including concrete construction on the new enlarged Welland Ship Canal.

In 1927 he moved to Vancouver, B.C., to become associated with Carter-Halls-Aldinger Co. as manager of their paving department for the Province of British Columbia, and remained with them until 1933. He led an active life until three years ago, when he was injured while on highway work in British Columbia under the Department of Public Works of the province.

He was for many years a member of the Engineering Institute of Canada and a Branch chairman while in Regina. He was a member of the B.C. Branch of S.P.S. Graduates until his death and was local chairman at one time.

F. J. A. Old, M.E.I.C., an engineer in the Department of Transport at Montreal, died suddenly on October 3rd in St. Albans, Vermont, on his way home after a holiday in New Hampshire.

Mr. Old was born in Gillingham, Kent, in 1888 and was educated at Sir Andrew Judd's Grammer School, Tonbridge, England; he was an articled pupil in civil engineering for three years with the South Eastern Railway in England.

In 1908, he joined the Ordnance Survey of Great Britain. He did survey work in Ireland, South Wales, and Central Africa, and he was on loan for a time to the National Defence Department in Ottawa as a topographer. From the outbreak of World War I, he served with the survey battalion of the Royal Engineer's. Before his discharge in 1919, he was loaned to the War Office in connection with the compilation of plans for the Peace Conference. He was mentioned in dispatches and received the Military Medal. He was for a time senior assistant with a civil engineering firm in Yorkshire until he came to Canada in 1921. Here he worked as a cartographer for the Department of Interior until 1932.

In 1934, he joined the staff of the St. Lawrence Ship Channel Branch of the Department of Transport of Canada, as an engineer, and was connected with a number of important projects and for several years had been in charge of extensive contract dredging in Montreal Harbour and vicinity. During recent months he was concerned with preparing plans for prospective channel improvements.

He joined the Institute as a Member in 1945.

R. F. A. Smith, M.E.I.C., refinery manager with the British American Oil Company Limited, at Montreal, died suddenly on December 7th in New York.

Mr. Smith was born in Pense, Saskatchewan, in 1909 and was educated at Moose Jaw College. He graduated from the University of Saskatchewan in 1932 in mechanical engineering, and in electrical engineering in 1933. He joined the British American Oil Company at Moose Jaw as field engineer and refinery operator. He later worked in Calgary as a plant superintendent, construction engineer and shift supervisor. He came to Montreal in 1940 as process engineer. In 1941, he was promoted to assistant manager and he became refinery manager in 1944.

Mr. Smith joined the Institute as a Member in 1945.

T. B. Ballantyne, M.E.I.C., office manager for the Canadian Pacific Railway, Eastern headquarters, since 1946, died at his home in Toronto on September 16th, 1951.

Mr. Ballantyne was born in Galt, Ontario in 1885. He attended McGill University graduating as a civil engineer in 1908. He joined the C.P.R. as a transitman in Montreal during that year and later served as resident engineer at Montreal, Smiths Falls and Schreiber, and as division engineer at Farnham. In 1935, he was promoted to district engineer for the Ontario district. He held this position until taking over special duties of office engineer in 1946.

He joined the Institute as a student in 1908, became an Associate Member in 1913 and Member in 1940. He attained his life membership in 1940. He was also a member of the Ontario Association of Professional Engineers and of the McGill Alumni Association.

L. H. Wheaton, M.E.I.C., construction engineer died on 16th November, 1951, in Toronto, where he had resided since his retirement in 1945.

Mr. Wheaton was born in Sackville, New Brunswick, in 1867. He graduated from the University of New Brunswick, and received a degree in civil engineering from the Halifax School of Technology. He began his career in the chief engineer's office of the Intercolonial Railway of Canada, and was chainman and rodman of the Pictou Town Branch, and rodman on the New Brunswick Short Line Survey.

His association with railway construction in the Maritimes continued, and he worked on railways in the United States, also. He was appointed chief engineer of the Coast Railway Company of Nova Scotia Limited in 1894. He worked at Moncton with the Transcontinental Railway; with the Department of Railways and Canals, at Dartmouth; and he was president of the Canadian Coal Company. He was in the empoy of the Department of Highways of Nova Scotia for some years before his retirement.

He worked also in the district engineer's office of the Department of Public Works, Halifax. During the Second World War, he joined the Department of Munitions and Supply and served as a government inspector for wartime construction until 1945 when he returned to his former position; he retired in 1945 and resided in Toronto.

Mr. Wheaton joined the Institute as an Associate Member in 1894, he attained his life membership in 1936.

J. D. Stott, M.E.I.C., structural engineer with the Shawinigan Engineering Company Limited, died in Montreal on November 22nd, 1951.

Mr. Stott was born at Lynn, Cheshire, England, in 1892 and was educated at Denstone College, Staffordshire and at Paisley Technical College, Scotland, and Manchester Technical College. He served an apprenticeship with Wolseley Tool and Motor Car, Limited, in Birmingham, and with Messrs Bow McLachlan and Company, Limited, Paisley, Scotland, working in their shops and drawing office. Later he became assistant engineer with Messrs. Healey Bros. in Manchester, England. With Fairfield Shipbuilding and Engineering Company Limited, Glasgow, and with other firms, he was engaged in work connected with marine engineering on the Clyde and on the design of cranes, lifting gear and ropeways up until the time he came to Canada in 1920 to work on design for the Dominion Bridge Company Limited at Lachine, Quebec. Three years later, he joined the Shawinigan Engineering Company Limited and contributed largely to the design of penstocks, gates, cranes and building framing for 15 major hydro-electric projects and for most of the structural features of terminal stations and sub-stations on the system of the Shawinigan Water and Power Company.

He joined the Institute as an Associate Member in 1921, transferring to Member in 1940; he was also a member of the Corporation of Professional Engineers of Quebec.

Employment Service

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

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

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

Situations Vacant

CHEMICAL ENGINEER required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

CHEMICAL ENGINEERS required for employment on technical staff of a new refinery in Western Canada. Some petroleum experience preferred but engineers with experience in allied fields will be considered. Remuneration commensurate with qualifications and experience. Apply to File No. 4128-V.

CIVIL

CIVIL ENGINEER for public utility in Toronto, Ontario. to act as junior location engineer. A professional engineer with at least 2 years experience on field surveys and location, to supervise surveys for overhead and underground transmission lines, inspect field construction work. Apply in writing stating age, education details of past experience and salary expected. Apply to File No. 4119-V.

CIVIL ENGINEER required by public utility in Toronto to act as assistant design engineer. A professional engineer with at least 2 years experience in transmission line design to assist on design work on transmission lines, conductor mechanics and fittings, steel and wood structures, footings, foundations etc. Apply in writing stating age, education, details of past experience and salary expected. Apply to File No. 4119-V.

ELECTRICAL

ELECTRICAL ENGINEER required by Toronto office of consulting engineers with experience in electro magnetic work. Apply to File No. 4121-V.

ELECTRICAL ENGINEER with about 2 or 3 years experience in industry required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

JUNIOR ELECTRIC ENGINEER required by large organization in Montreal for inspection department of the diesel locomotive division. Apply to File No. 4132-V.

MECHANICAL

MECHANICAL ENGINEER with about 2 years experience in industry required by chemical manufacturing plant in Province of Quebec. Apply to File No. 4126-V.

MECHANICAL ENGINEER required by paper company in Eastern Canada, to act as lubrication engineer. Applicant would work in close contact with plant maintenance engineers and lubrication engineers of the supplying oil companies. Age about 30 years. Salary according to qualifications. Apply to File No. 4133-V.

MECHANICAL ENGINEER, recent graduate, required for industrial engineering department in a mill in Eastern Ontario. Will be trained in time and motion study, synthesis, work simplification, scheduling, materials handling, etc. in a course lasting three months. Salary will be discussed at interview. Apply to File No. 4135-V.

MINING

TWO MINING ENGINEERS required by large mining and manufacturing organization in the Province of Quebec to take charge of surveying work underground. Apply to File No. 4124-V.

TWO SENIOR MINING engineers required by large mining organization in Province of Quebec for underground development. Apply to File No. 4124-V.

MISCELLANEOUS

TWO SALES ENGINEERS required by large manufacturer of industrial products and building materials with offices located in Montreal. Applicants should be mechanical or chemical engineers with preferably some industrial experience. Locations Quebec City and Montreal. Apply to File No. 4120-V.

YOUNG ENGINEER required by consulting firm in Toronto for job in Western Canada with experience primarily in water and sewer installations. Apply to File No. 4122-V.

ENGINEER TO ACT as sales engineer for old established business well known throughout Canada. Applicant should be about 30 years of age with 3 years experience in the pulp and paper industry. The location is Montreal with a certain amount of time spent visiting mills in this territory. Apply to File No. 4123-V.

FIVE MECHANICAL or Civil engineers for design and layout of buildings and equipment for asbestos milling operations. Apply to File No. 4124-V.

FOUR 1952 GRADUATES, 2 mining and 2 mechanical required by large mining organization in province of Quebec. Apply to File No. 4124-V.

CITY PLANNER required for Vancouver, B.C., to be responsible for the development and administration of the new city planning department in conjunction with a planning board of civic officials, to initiate and conduct studies, to promote, supervise and co-ordinate the planning and technical work with particular reference to zoning and subdivision control, to assist in formulating long-term improvement programs and through the above planning board, to act as technical consultant and advisor on matters affecting the growth and physical development of the city. Qualifications: University graduation in Civil engineering, Architecture or related field supplemented by courses in city planning, considerable planning experience including some supervisory responsibility, successful public relations, and administrative experience in municipal government, or an equivalent combination of training and experience. Salary $7,000.00 to $9,000.00 per annum depending on qualifications. Apply to File No. 4125-V.

ASSISTANT POWER STATION superintendent required by Hydro Electric Power Commission of Ontario. Applicants should have a sound practical and technical training and not less than 10 years experience in the administration, operation and maintenance of modern high pressure turbo-generators, P.F. boilers and auxiliaries. Mechanical or electrical engineer preferred. Salary range will extend to $7,800.00 per annum depending on qualifications and experience. Apply to File No. 4127-V.

FIELD ENGINEER to cover Maritime Provinces and Eastern Quebec. Applicants should be bilingual and university graduate with a minimum of 1 years selling experience, age approximately 23 to 40 years and owner of serviceable car. Based centrally in New Brunswick or Nova Scotia (preferably a native of that area) to be sole contact for technical sales of premium quality industrial power transmission V-belting and drives, full range of specialized industrial hose and other mechanical rubber goods, throughout industrial mining, lumbering, paper and construction markets, direct to largest consumers, through distributors. Preferably single and free to travel extensively. Position carries a base salary, car allowance travelling expenses and commission on all sales. Apply to File No. 4129-V.

INDUSTRIAL ANALYST graduate in engineering or science wanted by large Asbestos mine in Quebec. Applicants preferred who also have some education in business administration, commerce and finance or accounting. Selected individual would be trained to appraise financial desirability of making capital and operating expenditures. Age 25-30 years preferred. Salary depends upon qualifications. Apply giving details of education, experience, marital status and salary desired to File No. 4130-V.

RECENT UNIVERSITY graduate required as sales engineer for eastern Ontario by well established company. Situation could cover industrial centrifugals mainly. State age, experience, marital status, availability, salary expected and enclose photograph. Apply to File No. 4131-V.

WELDING ENGINEER required by large organization in Montreal with practical and theoretical knowledge of modern welding processes, in addition to a general engineering training. Apply to File No. 4132-V.

MACHINE DESIGNER with from four to five years experience preferably in automatic machines, but this is not essential, for mill situated in Eastern Ontario. This opening is in connection with the mechanizing of a large department in which many of the operations are now manual or semi-manual. Salary will be discussed at interview. Apply to File No. 4135-V.

CONSTRUCTION PERSONNEL ASSISTANT required by a company undertaking major construction programme in Eastern Canada. Duties include establishing methods of operation, directing personnel staff, selecting key non-manual personnel, engineers, purchasing agents, accountants, office managers etc. Qualifications — Canadian citizen, preferably under 30 years of age, graduate engineer with construction experience, possibly plus training in business administration. Excellent opportunity. Apply to File No. 4135-V.

BILINGUAL FIELD REPRESENTATIVE required by large Plywood Manufacturing Company in British Columbia for Quebec Province, to provide architects, engineers, contractors and users of

building materials with detailed technical information on plywood and allied specialties. Professional status as engineer or architect desirable, also ability in public speaking. Training period at mill in B.C. at full salary. Age around 29. Permanent position. Car furnished. Salary and expenses. Reply stating full details to File No. 4137-V.

MECHANICAL SUPERINTENDENT with manufacturing experience in machine shop production required by manufacturer in Province of Quebec of commercial firearms. Also required process engineer capable of taking charge of engineering process. These are permanent positions in a growing business. Apply to File No. 4138-V.

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

CHEMICAL

CHEMICAL ENGINEERS with 2 to 4 years operation experience in the chemical industry. Successful applicants will be given 6 months special training period in the U.S.A. before being permanently located in Central Alberta by a major organic chemical industry in the production department. Apply to File No. 4075-V.

CHEMICAL ENGINEERING department of a large Canadian University will have a vacancy in the staff at the professorial level in the 1952-53 session. Major qualifications: ability to teach and direct research in the unit operations field, a good background in physical chemistry. An interest in the petroleum field would be useful though not necessary. Apply to File No. 4076-V.

CHEMICAL ENGINEERS required by a paper company located in Province of Quebec. Time and motion study engineers with at least 2 years experience in time and motion study methods, plant layout, machine loading and operation write up. Time and motion engineers should be free to travel. Apply to File No. 4082-V.

CHEMICAL ENGINEER required with 3 or 4 years experience preferably in the pulp and paper industry. Location Province of Quebec. Apply to File No. 4096-V.

CHEMIST OR CHEMICAL ENGINEER required by public utility in Maritime province. Work consisting of directing the control of water conditioning in the steam station, the control and conditioning of transformer and lubricating oils, and the preservation of wood poles and structures. Salary based on experience and qualifications. Apply to File No. 4102-V.

CHEMICAL ENGINEER required for an expanding chemical industry in Western Canada. Prefer applicants with some experience and/or interest in cost analysis, plant economics and market studies. Challenging opportunity for someone leaning towards the economical phases of business operations. Age range 25 to 35 years. Apply to File No. 4116-V.

CIVIL

EIGHTEEN CIVIL engineers required in head office, Tel Aviv, for surveying, designing and planning of roads, for construction planning and structural design of water and sewage works. Length of service a minimum of 2 years. Permanent position to begin as soon as possible. Qualifications: academic diploma or membership in a recognized professional organization with at least 2 years experience. Knowledge of Hebrew is desirable but not essential. Apply to File No. 4070-V.

TWENTY-SEVEN CIVIL engineers for supervision and field work of road work, bridges, buildings, water works, sewage and other public works. Location Tel Aviv and surrounding districts. Length of service a minimum of 2 years. Qualifications, academic diploma or membership in a recognized professional organization. Experience, at least 2 years. Specialized knowledge in equipment necessary for public works. Knowledge of Hebrew desirable but not essential. Age 24 to 40 years. Apply to File No. 4070-V.

CIVIL ENGINEER required for general contractors office in Montreal. Work consists of estimating, quantity take-offs, purchasing materials and construction design. Applicant should have 2 or 3 years experience. Salary commensurate with experience. Apply to File No. 4072-V.

CIVIL ENGINEER required by construction company in Province of Quebec preferably recent graduate who would be interested in building construction work as assistant to job engineer. Apply to File No. 4080-V.

CIVIL ENGINEERS required for large construction programme in Northern Canada, various locations. Six field engineers, chief of survey party, instrumentmen and draughtsmen. Head offices located in Montreal. Apply to File No. 4091-V.

CIVIL ENGINEER required for construction of service stations by petroleum marketing company located in Montreal. Applicant should be recent graduate and preferably bilingual. Apply to File No. 4094-V.

CIVIL ENGINEER, for town located in New Brunswick. Applicant should be well qualified. Reply in writing giving full particulars as to experience, qualifications, references and salary expected. Apply to File No. 4099-V.

JUNIOR CIVIL ENGINEER to follow basic design of structures. An excellent opportunity to understudy a highly qualified senior engineer. Mathematical aptitude essential. Location Maritime Province. Apply to File No. 4108-V.

CIVIL ENGINEER to act as estimator in contractors office located in Montreal. Applicant should have 5 to 10 years experience. Apply to File No. 4114-V.

ELECTRICAL

ELECTRICAL ENGINEER required by public utility in Ontario. Graduate with general knowledge of public utility operations. Apply by letter stating age, qualifications, experience and salary expected. Apply to File No. 4079-V.

APPLICATIONS ARE invited for the post of professor and head of the department of power engineering in the India Institute of Science, Bangalore (India). The candidates should possess a degree in electrical engineering and should possess very high academic qualifications and experience, associations with engineering and technical institutions and teaching experience are necessary qualifications. For further information apply to File No. 4086-V.

ELECTRICAL ENGINEERS required to act as field service engineers for the overseas operations of Montreal manufacturer of specialized instruments. Duties include trouble shooting and supervision of installations of equipment. Age 26 to 35 years. Apply to File No. 4087-V.

TWO ELECTRICAL or electronic engineers required by specialized industrial plant in Montreal area. Applicants should have 5 to 10 years experience in production control. Apply to File No. 4088-V.

ELECTRICAL DESIGN ENGINEER with experience in lighting and power distribution in commercial and industrial buildings required by large consulting engineering firm located in Montreal. Apply to File No. 4097-V.

TWO ELECTRICAL ENGINEERS required with some experience in design and testing of electrical appliances and equipment, by specialized laboratories in Toronto. Applicants should have preferably at least two years experience in the field. Apply to File No. 4100-V.

ELECTRICAL ENGINEER required by manufacturer in Montreal for design of and supervision of manufacture of miscellaneous electrical panels for fire alarm systems, clock systems, etc. Correspondence re details of orders for special material. Company operates on a five day week, employs just over 100 persons, has a company subsidized sickness and accident plan. Apply to File No. 4107-V.

A JUNIOR ELECTRICAL engineer to assist in design and installation of electrical switching and control equipment. Location Maritime Province. Apply to File No. 4108-V.

ELECTRICAL ENGINEER of 5-8 years experience in the design and installation of transmission, substation and control equipment commonly associated with 4 to 132 K.V. systems. Must be qualified to take responsibility for variety of electrical construction. Location Maritime Province. Apply to File No. 4108-V.

ELECTRICAL ENGINEER required for the design and sale of electrical panelboards, switchboards. Applicant must be bilingual. Location Province of Quebec. Apply to File No. 4112-V.

ELECTRICAL ENGINEER required by Ontario works to act as works engineer. Duties would include heading up a small manufacturing department, customer contact, initiating and handling internal routine of sales orders, directing production and material control and manufacturing planning. Applicant should be a graduate electrical engineer with at least five years' experience preferably on motor control, switchboard or similar apparatus. He should be familiar with modern manufacturing methods as applied to this type of equipment. This position will provide an excellent opportunity for any young engineer to establish himself in a new division of one of the largest companies on the continent. Apply to File No. 4117-V.

MECHANICAL

YOUNG MECHANICAL ENGINEER required by manufacturer in Ontario for time study and methods work. Salary depending on qualifications and experience. Apply to File No. 4068-V.

MECHANICAL ENGINEER required in Province of Quebec with approximately 5 to 10 years experience. Duties include general plant operations and to offer constructive ideas regarding operating problems in conjunction with process equipment, piping power drives, heat transfer fans and building structure etc., to assume responsibility in designing and putting the above ideas into effect and be capable of working effectively with master mechanic tradesmen and other plant personnel. Apply to File No. 4074-V.

MECHANICAL ENGINEER required to act as assistant plant engineer for new operations in Ontario. Applicant should be capable of supervising installation of plant machinery, plant layout and building structures, air, water, steam and sewer lines. Apply to File No. 4085-V.

MECHANICAL ENGINEER required by specialized industrial plant located in Montreal area. Applicant should have 5 to 10 years experience in production. Apply to File No. 4088-V.

MECHANICAL ENGINEER required to act as sales engineer by Montreal manufacturer of all types of sheet metal work. Applicant should have definite sales ability and be preferably a Montrealer. Apply to File No. 4090-V.

MISCELLANEOUS

ENGINEER WITH SOME experience in sewer design and construction and also experience in sewage treatment, required by public utility in Western Canada. The latter experience is more essential as plans are being made for the rehabilitation of the sewage treatment plant. Salary according to qualifications. Apply to File No. 4065-V.

ENGINEER WANTED

CITY OF SARNIA, ONTARIO

Applications addressed to the undersigned will be received for the position of Commissioner of Streets for the City of Sarnia.

Applicant must be a fully qualified engineer with experience in and capable of directing the operations of road maintenance and construction, sidewalks, curbs and gutters, street cleaning, snow removal and garbage collection and disposal. Experience in the operation of asphalt plants desirable. The man appointed will have complete charge of these operations together with any other duties relative to streets.

Salary will be in the range of $4,500. to $5,000. and will depend on qualifications and experience.

E. ROYDEN COLTER, City Manager.

The Hydro-Electric Power Commission of Ontario

RICHARD L. HEARN

Generating Station, Toronto, ultimate capacity 400 MW

ASSISTANT POWER STATION SUPERINTENDENT

Applications are invited for the position of assistant power station superintendent at the above noted power station just recently commissioned.

Applicants should have had a sound practical and technical training, and not less than 10 years experience in the administration, operation and maintenance of modern high pressure turbo-generators, P.F. boilers and auxiliaries.

Applicants should be capable of organizing and training station staff up to a standard which will maintain plant at maximum availability and efficiency. An Engineering degree (Mechanical or Electrical) or membership in a recognized engineering association will be an advantage.

Salary range will extend up to $7800. per annum depending on qualifications and experience.

Employee benefits include pension and insurance scheme, holidays and sick leave.

Apply in writing stating age, education, details of past experience to employment office, 620 University Ave., Toronto, Ontario.

RESPONSIBLE OPENING IN engineering department of firm manufacturing industrial gases and welding equipment. Applicant must be a graduate engineer and should have experience in a metal fabricating plant. After suitable training the individual will perform consulting engineering duties in the use of our equipment and products. Excellent opportunity along technical administrative lines for suitable person. Salary will be commensurate with qualifications. Apply to File No. 4066-V.

A LARGE PAPER manufacturing company in the province of Quebec requires a competent man to head up a new research project involving the fundamentals of paper making and machine design. Applicants should have an honors degree or a doctorate in either mechanical engineering, chemical engineering or engineering physics and must have some knowledge or experience in organizing research, some knowledge of paper manufacture is desirable. When replying give full details of education, technical experience, marital status, etc., and include photo. Apply to File No. 4069-V.

MECHANICAL AND ELECTRICAL engineers for planning and supervision of airconditioning and power plants in buildings, supervision of technical equipment for buildings and public works, planning and installing heating and hot water systems for cooling systems in buildings, required in Tel Aviv. Length of service a minimum of two years to begin as soon as possible. Qualifications: academic diploma or membership in a recognized professional organization with 3 to 10 years experience. Knowledge of Hebrew desirable, but not essential. Age 25 to 40 years. Apply to File No. 4070-V.

ENGINEER REQUIRED in the office of city engineer in Western Canada with experience on reinforced concrete structures and building design, for the design of an incinerator and building and provide such accessory services as may be required. Apply to File No. 4071-V.

ASSISTANT FACTORY MANAGER required by internationally known manufacturer of power equipment. Applicant must have a good technical background and extensive experience including several years management in the mechanical or preferably the electrical engineering field and be familiar with labor relations, employee training, cost estimating and accounting, factory organization and maintenance, modern production methods and equipment and be preferably bilingual. Please include photograph. Apply to File No. 4073-V.

AN ONTARIO MANUFACTURING company with sales offices across Canada making and marketing heating equipment used in all types of buildings requires an experienced business sales and advertising executive. He should have contacts with architects and the construction industry and have proven executive abilities. An opportunity for a young man 35 to 40 years old, married, ambitious, temperate in habits. All applications will be treated confidentially. Send complete details regarding age, marital status, education, etc., with at least two business and character references. Apply to File No. 4077-V.

SALES ENGINEER required by manufacturer of machinery tools and supplies to cover central and western Canada. Apply to File No. 4078-V.

INDUSTRIAL ENGINEER required by large manufacturer in Toronto. Applicant should be a recent graduate with one to two years experience in time-study, budgetary control, cost reduction, preferably in the metal industry. Apply to File No. 4084-V.

JUNIOR ELECTRONIC engineer required by specialized industrial plant in Montreal for research laboratory work. Experience not essential. Apply to File No. 4088-V.

ASSISTANT MANAGER required by progressive manufacturer for over a quarter of a century in a small town in the Povince of Quebec. Applicant must have experience in office management, metal stamping and sheet metal work. Must be bilingual. Excellent opportunity for the right man to become General Manager in a few years. Apply to File No. 4101-V.

TWO JUNIOR RESIDENT ENGINEERS required by public works in Newfoundland for work on highway and bridge construction. Recent graduates or engineers graduating in 1952. The posts are permanent and pensionable on the salary scale of $2,700.00 to $3,800.00 per annum, in addition a cost of living bonus of $570.00 per annum for salaries below $3,100.00 and $480.00 for salaries $3,100.00 and over is applicable. Apply to File No. 4105-V.

YOUNG MAN WITH ENGINEERING, landscaping training required by expanding memorial Gardens Cemetery Company, based in Toronto. Knowledge of construction, drafting and costing required. Also knowledge of large scale landscaping and planting is desirable. Some travel. Excellent opportunity for right man. Apply to File No. 4106-V.

A MECHANICAL OR CHEMICAL engineer required by public utility in Maritime Province familiar with high pressure steam power plants and the fundamentals of boiler water conditioning. Apply to File No. 4108-V.

CHEMICAL AND MECHANICAL engineer for instrumentation control and development in newsprint mill. Should have some pulp and paper experience. Apply to File No. 4109-V.

AMERICAN MANUFACTURER of industrial pumps requires engineer to act as sales engineer. Working from Montreal headquarters territory would be Eastern Canada where products have already been introduced. Applicant should be recent graduate with some experience in the oil industry or pulp and paper and be preferably bilingual. Apply to File No. 4110-V.

ENGINEERS required for rapid expansion programme in aircraft industry. Apply to File No. 4115-V.

Situations Wanted

GRADUATE CIVIL ENGINEER AND LAND SURVEYOR with proven ability to carry out responsibilities. Available on short notice. Over 23 years of wide experience on four continents. Experience includes design layout and field supervision of roads, dams, buildings, drainage, irrigation works. Veteran C.R.E., and E.A.E., married, bilingual. Situations held in Canada; chief of survey parties, resident engineer, abroad: as district and assistant chief engineer for over 19 years in the British, Turkish, Iraqui, Government services. Apply to File No. 489-W.

MECHANICAL ENGINEER, 1950 graduate with varied experience in manufacturing, desires position in Ontario. Apply to File No. 1216-W.

MECHANICAL ENGINEER Jr.E.I.C., 1948 University of Saskachewan graduate, 2½ years research and testing 1 year mechanical design experience. Interested primarily in the technical side of engineering. Desires new position. Apply to File No. 1458-W.

MECHANICAL AND INDUSTRIAL ENGINEER P.Eng., M.E.I.C., graduate 1927, bilingual, first class references, experienced in production, business administration, design, methods installation, presently employed, desires responsible position. Apply to File No. 1730-W.

MECHANICAL ENGINEER M.E.I.C., B.A.Sc. Age 37, married. 3 years experience as a designer in paper machinery department of large manufacturer. 5 years as officer in the A.I.D. of the R.C.A.F. engaged on technical and administrative duties. 7 years as engineer in the pulp and paper and sawmill industry engaged in the study, layout, design and installation of wood handling plant and equipment including considerable experience in the design and erection of structures. Desires senior position in field of industrial planning and development. Apply to File No. 1985-V.

WELL QUALIFIED ELECTRICAL and mechanical engineer, 31, with ten years experience in equipment manufacturing, chemical plant operation and design of large industrial steam and power generation and distribution systems would welcome change of employment leading to increased responsibilities. Aggressive, efficient and capable of handling complete projects. Cost conscious. Could be available at 30 days notice. Please address enquiries to File No. 2912-W.

CIVIL ENGINEER, M.E.I.C., desires to obtain part time work (evenings and Saturdays), design and detailing in reinforced concrete and structural steel in Montreal. Apply to File No. 3315-W.

MECHANICAL ENGINEER, M.E.I.C., P.E., QUEBEC, seeks position with progressive organization where training and experience could be best utilized in administration or production. Experience includes 5 years as works manager of large engineering plant, with previous experience in design, inspection, manufacturing and machine shop experience. Apply to File No. 3355-W.

MECHANICAL ENGINEER McGill 1951, S.E.I.C., S.A., age 23, single. Presently employed. Desire position with heating and ventilating firm located in Montreal. Apply to File No. 3425-W.

ENGINEER, M.E.I.C., wide experience design, construction, operation and maintenance of plants making coal and synthesis gasses and bye products, kraft pulp and sugar. Thorough knowledge of all classes of refractories settings and coke ovens, steel and concrete structures, piping, tanks and vessels, mech-

anical handling equipment, boiler plant hydraulics and associate equipment; also experience in naval architecture and shipyard routine, age 46, married, free to travel. Available early January. Apply to File No. 3505-W.

CIVIL ENGINEER: B.Sc. (Hons.), University of Glasgow, 23 years old, Scot, 3 years experience industrial building, including R.C. designs, estimating and resident engineers duties. Arriving in Canada mid-January. Would consider position in construction, design office or sales. Apply to File No. 3647-W.

EXPERIENCED BUYING ENGINEER, Higher National Certificate in Mechanical Engineering, age 31, married, one child. At present employed by a large industrial organization in the U.K. intends to immigrate to Canada early in 1952 and wishes to obtain a similar post in Canada. Apply to File No. 3727-W.

CIVIL ENGINEER (British, London, England), University Graduate. Age 36, with practical experience in road construction, surveying, steel structures and mainly reinforced concrete (framed structures for blocks of flats, industrial buildings, heavy foundations for power station, steel mills and gas works), used to work on own initiative and responsibility, attending to correspondence, site meetings, etc., at present leading a team of designer-detailers, draughtsmen and tracers, wishes to emigrates to Canada and desires responsible position with construction company or consulting firm. Apply to File No. 3749-W.

BRITISH ENGINEERING Executive, D.L.C. (Hons.), Grad.I.E.E., M.Inst. B.E., seeks opening in Canada. At present Chief Engineer to medium sized company operating several factories and making electronic products. Also acting as manager of one of these production units. Wide experience in all phases of management and in technical supervision of laboratories and workshops. 31 years of age, single and able to travel at short notice. Apply to File No. 3755-W.

PART TIME WORK: Graduate Civil Engineer, Jr.E.I.C., desires part time work in Montreal for evenings and week-ends. Some experience in design of steel, reinforced and prestressed concrete structures and bridges. Apply to File No. 3773-W.

CIVIL ENGINEER, Jr.E.I.C., Montreal 1946, age 29, married, bilingual. 5 years experience on road construction projects; some knowledge but no experience in metallurgy. Would like to acquire more varied experience in either construction or metallurgy. Apply to File No 3774-W.

ENGINEER, Jr.E.I.C., B.A.Sc., University of B.C. M.Sc. Civil Engineering Utah State Agricultural College 1951. Special training in Hydraulics and soil mechanics. 27 months experience in drainage, irrigation work involving survey, small dam construction, wash-bore drilling. Present position responsible for field and office work 3 survey crews. Desire research, teaching or extension work. Consider foreign appointment. Experienced public speaker and research report writer. Ex-navigator R.C.A.F. 4 years overseas. Married. Age 30. Apply to file No. 3776-W.

YOUNG MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., single, 5 years design experience in process industries, power and construction, desires a position as a group leader, plant engineer or any related position offering a genuine opportunity for initiative and advancement. Personal interview by appointment. Available on two weeks notice to present employer. Montreal preferred. Apply to File No. 3777-W.

GEOLOGICAL ENGINEER, S.E.I.C., recent graduate, 24 years old, single, bilingual, with experience in geological exploration and valuation of ore deposits desire position as production or industrial engineer. Available on short notice. Apply to File No. 3778-W.

CIVIL ENGINEER, 27, B.Eng., McGill 1949, Jr.E.I.C., P.E.Q., P.E.O. Presently employed with a steel construction firm, 3 years experience prior to university and 3 years of design experience Type of experience in design work covers: design of bridges, factory buildings, apartment buildings, transmission towers and structures, guyed and self supporting radio masts. Interested in working with a construction firm or general contractor, preferably with the option of becoming a junior or full partner. Apply to File No. 3779-W.

ELECTRICAL ENGINEER, Jr.E.I.C. — Prof. Engineer (Que.), graduated 1944, 34 years old, married, two children. Six years of sound practice with construction crews of pole lines. Good knowledge of pole line wires and hardware, and of wiring material for buildings. Can prepare layouts, specifications, estimates. Sound practice on metering outfits, and special substations. Mathematician and author of many short cuts for calculating regulation, power loss of a line. Can work anywhere preferably in Eastern Canada for a progressive company or contractor. Apply to File No. 3783-W.

CHEMICAL ENGINEER, 1950, University of Toronto, desires production or process work in Ontario or Western Canada. Age 28, single. Presently engaged in development work and production problems. Apply to File No. 3784-W.

RETIRED SENIOR executive, M.E.I.C., requires full or part time employment. Personnel, public relations, administration or supervision or inspection of construction. Apply to File No. 3785-W.

AMBITIOUS YOUNG MAN, age 26, 3 years study in chemical engineering (1947-51), desires permanent position where hard work and initiative will lead to advancement. No location preference. Available on short notice. Apply to File No. 3786-W.

CIVIL ENGINEER, S.E.I.C., B.Eng., McGill,, 1951. Age 29 years, married, one child. Veteran 5½ years R.C.N. Speak and write French. One summer machine operator on punch press, screw machine. Three summers municipal engineering in surveying, design and construction of sewerage system, watermains, streets. Presently employed in railway maintenance of way. Desires position in design and construction field or in plant engineering. Available on two weeks notice. Apply to File No. 3788-W.

INSTRUMENT ENGINEER, B.Sc., Civil Engineering, 1947, M.E.I.C., P.Eng. Age 26, married. Practical knowledge of flow measurement, process control applications and instrument maintenance as well as varied construction experience. Seeks employment in field of instrumentation where hard work and initiative will lead to advancement. Apply to File No. 3789-W.

CIVIL ENGINEER, D.L.S., M.E.I.C., age 61, and too active to stay in retirement after 35 years government service, desires responsible position. Background of 37 years field engineering and administration, surveys, highway construction and design, bridges, sewage disposal, water supply, reinforced concrete structures. Would consider position as municipal engineer with town in Ontario or Maritimes or as resident highway engineer in Ontario or Eastern Province, or office engineer with private company. Apply to File No. 3790-W.

CIVIL ENGINEER, B.Sc. (Dalhousie 1948), B.E. (N.S.T.C.) 1951, S.E.I.C., age 23, married, no children Interested in Hydro-Electric work, design and construction of reinforced concrete, steel and timber structures. Would like to work for large company with opportunity to work into managerial or administration position. Experience includes one summer with DOSCO as junior engineer, two summers with R.C.E. studying military engineering, one summer at Churchill, Manitoba, supervising construction, six months with Dyking Board in B.C. supervising construction of reinforced concrete flood box, six months R.C.S.M.E. instructing demolitions. Available on one month's notice. Apply to File No. 3791-W.

CIVIL ENGINEER, S.E.I.C., 1952 graduate in app. mechanical option. 1 year experience in structural drawing (reinf. conc.) and some field experience. Seeks job as designer (steel or reinforced concrete), work on buildings or preferably hydro-development. Apply to File 3805-W.

CONSTRUCTIONAL ENGINEER, age 38, wide experience in building and civil engineering, now manager of a building firm in Switzerland, leaving for Canada in the middle of March 1952, seeks independent and responsible position as supervisor for ferro-concrete works, building and civil engineering. Apply to File No. 3806-W.

ENGINEERING AND BUSINESS — 1950 Grad., S.E.I.C., age 28, veteran, married. Desires position in sales or as assistant to sales manager on technical lines. Anxious to start at bottom, learn and climb as value to organization is established. Apply to File No. 3807-W.

EXPERIENCED MECHANICAL ENGINEER, M.E.I.C., 38, married, 2 children. 8 years chief engineer, widely travelled, experience in maintenance, purchasing, lay-out, electrical, heat treatment, handling of men and materials, problems of wear, corrosion and fatigue. Good background of metallurgy, economics, costing, statistics. At present employed, seeks senior position requiring responsibility, methodical thinking and the ability to get on well with those above and below him. Apply to File No. 3808-W.

JUNIOR EXECUTIVE — Age 31, Bachelor of Science and Bachelor of Commerce degrees. 10 years experience in electronic industry, 3½ years paper industry, 1½ years metal valve industry. Experienced in supervision, plant and equipment layout, mechanical design, expediting, production control, production methods, maintenance, plant engineering. Desires responsibile position as assistant to senior executive. Apply to File No. 3810-W.

MECHANICAL ENGINEER (University Vienna, Austria), specialized in Refrigeration and Air Conditioning, experience in heating, ventilation, construction of vessels, tanks, coils, pipe lines, etc., sales management, calculations and estimates, automatic control, 10 years experience in Europe and last years in Mexico. Speaks English, French, Spanish, German. Desires corresponding position. Presently located in Ontario. Apply to File No. 3811-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., B.A.Sc., Toronto 1944. Experienced in petroleum engineering development; at present employed in business administrative capacity but planning on a change; married with two children; position must guarantee to keep me up to my ears in work and give ample opportunity for advancement. Apply to File No. 3812-W.

GRADUATE CHEMICAL ENGINEER, N.S.T.C. 1950, Jr. E.I.C. Age 25, married. Employed two summers while undergraduate with large steel plant in Nova Scotia. Employed since graduation with mining company. Desire permanent position in production organization. Interested in any position where hard work and capability leads to advancement. Apply to File No. 3813-W.

Attention, Members

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News of the Branches

Activities of the Thirty-seven Branches of the Institute and abstracts of papers presented at their meetings

Belleville

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

December Meeting

The eighth meeting of the Belleville Branch and the second of the 1951-52 season was held at the Quinte Hotel, December 10, 1951, with 35 present.

The chairman of the meeting was Mr E. G. Gurnett. The secretary, reporting, explained that the elections to be held later in the evening would bring the executive up to strength, and reorganize it in accordance with the proposed by-laws.

Mr. A. Janitsch and Mr. R. L. Brown volunteered as auditors of the annual financial statement.

Approval was obtained of the Branch's confirmation of the appointment of Dr. J. B. Stirling for the office of president of the Institute for next year.

Mr. Sillitoe announced that Col. L. F. Grant would be the speaker at the next meeting January 14.

Mr. Gurnett then turned the meeting over to the chairman of the Nominating Committee, Mr. F. Adsett, who reported that the slate of officers recommended by the committee in accordance with the proposed by-laws was as follows, and that they and the remaining officers of the executive would continue in office until the annual meeting in April: chairman, E. G. Gurnett; vice-chairman, G. A. Bradford; councillor, S. Sillitoe; committee, W. L. Langlois, J. E. Buchan, A. O. Drysdale, C. R. Whittemore, J. C. R. Punchard, A. E. Argue.

A new secretary-treasurer was to be appointed by the executive at their next meeting, December 17.

Upon motion from Mr. A. Janitsch, seconded by Mr. C. R. Phillips, nominations ceased, and the executive was unanimously voted into office.

Upon motion from Mr. C. R. Whittemore, Mr. S. Sillitoe was appointed to act as Belleville representative on the headquarters Nominating Committee.

After the business session Mr. Gurnett called upon Mr. A. Legate to introduce the speaker, Mr. R. A. Crysler, M.E.I.C. P.Eng., of the technical staff of the Canada Cement Company, who addressed the meeting on the subject "Prestressed Concrete".

Contrary to general belief, the principle of "Prestressed Concrete" is not new, and first patents date back to 1886 in Germany. The principle is even older than that, and had its fundamental basis in such commonplace objects as the barrel, with its staves and hoops, the origin of which is lost in antiquity. The basic principle is that by putting initial compression into the material, greater than any tensile load stress encountered, about half the amount of concrete is required for the same strength. In European countries where material costs are high, research and development along these lines was naturally stimulated. When it is realized that in the usual reinforced concrete beam only the one-third of the concrete in the beam above the neutral axis is effective for sustaining compressive stresses while the remaining two-thirds serves largely to contain the reinforcing steel, the advantages of prestressing are clearly evident.

Mr. Crysler emphasized that "reinforced" and "prestressed" concrete are two different things. In the latter case the concrete is never in tension, but is compressed initially to achieve better balance in load distribution between steel tension members and the concrete compressive members. There are two methods: pretensioning which is convenient for prefabrication of slabs on precast beams in shops; and post-tensioning which is more applicable in field construction. The latter method usually involves the threading of high tensile wires or ropes through ducts cast in the concrete, prestressing being achieved by use of heavy jacks and cone or wedge clamping devices which are later "grouted in."

To illustrate in a most effective way the principles and methods covered in his paper, Mr. Crysler showed a coloured sound film of the construction of the Walnut Lane Bridge in Philadelphia. This beautiful structure is one of the latest contributions to this art, and the picture showed in detail every phase of the development and test of the prototype girders, as well as the whole construction programme of the bridge itself.

The appreciation of the audience was expressed by Mr. W. L. Langlois.

Calgary

D. C. Jones, M.E.I.C.,
Branch Secretary

F. Tempest, M.E.I.C.,
Branch News Editor

November Meetings

The November activities of the Calgary Branch were marked by two most interesting meetings held at the Palliser Hotel on the evenings of November 8 and November 22.

The speaker at the meeting of November 8 was Mr. R. A. Hemstock, an engineer of Imperial Oil Limited now located at the Redwater oil field. Mr. Hemstock chose for his subject "Permafrost Problems in Oil Development in Northern Canada," a subject on which he is well qualified to speak, having spent several years at Norman Wells, Canada's most northern producing oilfield and refinery situated almost at the Arctic Circle.

The ground at such northern latitudes is permanently frozen to a considerable depth, and only a few feet at the surface thaws out during the long days of the short summer period.

Foundations for buildings, derricks and machinery had to be based on piles jetted by steam into the permafrost. The depth of pile penetration into the permafrost has to be at least two and one-half times that of the possible thawing-out depth above the permafrost, in order to prevent heaving of the piles during the process of refreezing after thawing.

Another method of preventing heaving is to insulate the ground under a building or foundation to prevent thawing of the ground between the project and the permafrost.

The speaker for the meeting held on the evening of November 22 was Mr. J. S. Charlesworth, chief chemist for the Research Council of Alberta.

Mr. Charlesworth spoke of the many and varied activities of the Council, but he dealt chiefly with work carried out in connection with the petroleum industry. The work in connection with checking specifications of gasolines, lubricating oils and other petroleum products purchased by the Provincial Government was outlined. An account

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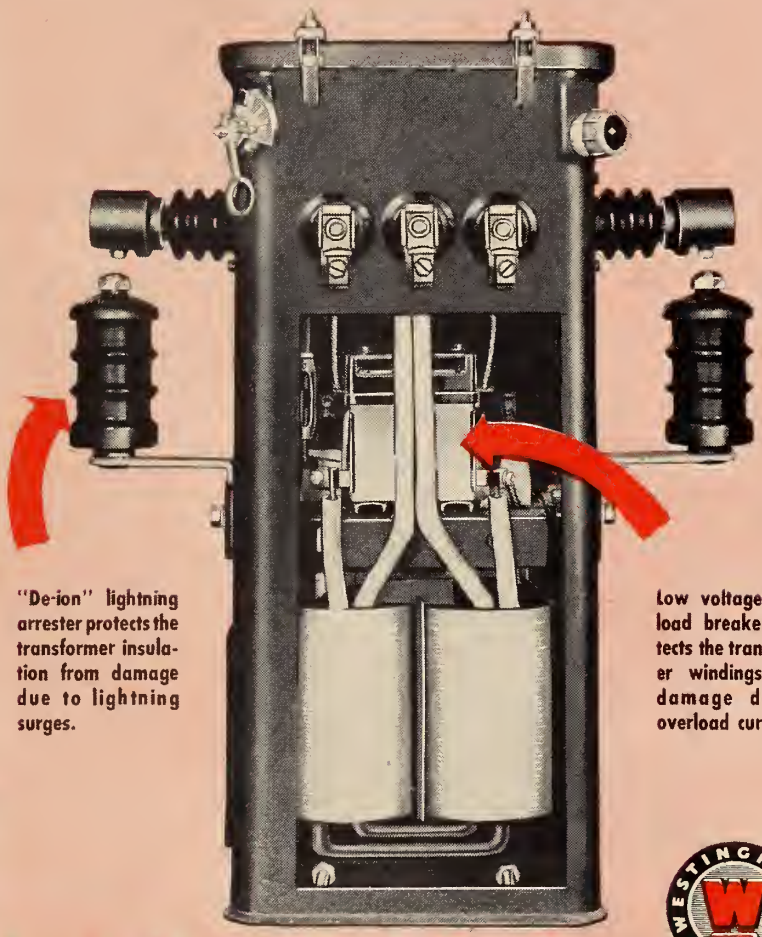

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was given of tests carried out for the armed forces under various weather conditions, particularly in the extreme cold experienced in Arctic regions.

The Research Council has also done extensive work on deterioration and breakdown of aviation gasolines in storage.

Central British Columbia

M. L. Zirul, M.E.I.C.,
Secretary-Treasurer

Annual Meeting

The annual meeting took the form of a joint dinner meeting with the Central B.C. Branch, B.C. Engineering Society, November 23, 1951, at the Legion Hall, Kelowna, B.C. Twenty-nine were present, including eighteen E.I.C. members.

Mr. Don Richardson of Nelson, and Bert Shore, Vancouver, representing the Johns Manville Company, had travelled over from Trail to attend the meeting. Mr. Shore gave a brief talk on the history of "Transite" asbestos base pipe, and a film "Underground Arteries" was shown, outlining the manufacture and many uses of "Transite" pipe.

The business session of the evening was divided into two parts, annual meeting of the Central B.C. Branch, E.I.C., and annual meeting of the Central B.C. Branch, B.C.E.S. Chairman F. McCallum presided over the annual meeting of the E.I.C.

Members were given printed copies of the annual report of the branch. Chairman McCallum, in a retiring address, spoke of the growth of co-operation between the two groups, the local branches of the E.I.C. and B.C.E.S. He stressed the importance of striving to a uniform national registration for all engineers. He outlined the work done by the branch during the last year, and recommended to the incoming executive that they set up as many active working committees as necessary to distribute the work of the branch and enable it to be carried out to best advantage. He recommended in particular, an attendance committee to stimulate attendance of as many members as possible at all meetings.

Election of the 1952 executive had been held by letter ballot, members Geo. Fyke and H. Topham acting as scrutineers. The new executive was elected as follows: chairman, H. Hatfield; vice-chairman, R. L. Bigg; Committeemen, W. A. Ker, L. E. Willis, M L. Zirul.

The remainder of the evening was devoted to the annual meeting of the Central B.C. Branch, B.C.E.S., after which a question and answer period on the film that had been presented, was held, Mr. Shore and Mr. Richardson answering all queries in regard to uses of the pipe.

Cornwall

John A. Sarjeant, Jr.E.I.C.,
Secretary-Treasurer

A. A. B. McMath, M.E.I.C.,
Branch News Editor

Annual Dinner Meeting

B. T. Yates was elected chairman of the Cornwall Branch at the annual meeting at Hotel Cornwallis December 4. He succeeds H. W. Nickerson.

Other executive officers elected when the report of the nominating committee was adopted included J. Morris, J. M. Hawkes, R. L. Blackett and J. E. Pescod. The committee was headed by W. H. Malone.

In his annual report, A. S. Holder, chairman of the membership committee, reported the branch had increased from 68 to 74 members during the year.

The retiring chairman introduced Drummond Giles and J. B. Sterling of Montreal, both of whom gave brief addresses. Mr. Sterling commented on the recent formation of four new branches of the Institute in various Canadian centres.

Four films on engineering subjects were shown.

Meeting With Field Secretary

On December 7, ten members of the executive, including three retiring members, met with Col. L. F. Grant, field secretary of the Institute, at the Hotel Cornwallis. Col. Grant discussed various problems, such as the possibility of increasing his staff; the need for better relations with the various Professional engineer associations; and the steps already taken by some branches to provide courses for junior engineers.

Halifax

W. E. Jefferson, M.E.I.C.
Secretary-Treasurer

M. F. Dean, M.E.I.C.
Branch News Editor

November Meeting

On November 20 Mr. E. D. Bent, chief engineer of the Wire and Cable Division of the Northern Electric Company, addressed the branch members on the subject of "Insulated Wires and Cables for Power Transmission."

Mr. Bent divided his subject into the two natural divisions of carrier materials and insulating materials, and spoke chiefly about the latter. Factors affecting choice of materials for insulators are: dielectric strength, impulse strength, physical resistance to fire, heat and bending failures, and chemical resistance to corrosion, oil penetration, ozone and acids.

Common insulators that meet some of the requirements are oil impregnated paper, varnished cambric, pure and synthetic rubber (of which there are 58 different compounds) and plastics.

The impregnated paper insulators are good for any present load, while the others have limited capacities due to lower dielectric and impulse strengths. Plastics are vulnerable to sudden overloads which melt the material, and therefore are good only below their critical temperature. There has not yet been unqualified acceptance of this material as an insulator.

Many insulators having high resistance to electrical forces have poor physical and chemical qualities. To overcome this the insulator is often covered over with a sheath. Materials for this part of cables are lead, rubber, neoprene, some plastics, and an armour of braided wire, either galvanized steel or aluminum alloy.

Mr. Bent showed two interesting films: one on the processes in the Lachine wire and cable plant, and the other on the laying of two underwater cables in British Columbia.

The meeting unanimously agreed that Mr. Bent's lecture provided an extremely interesting evening, and he was heartily thanked.

Annual Business Meeting

The 1951 annual business meeting of the Branch was held on December 13.

After the previous meeting's minutes were read and approved, reports were read on the Branch Officers Conference, by J. W. MacDonald, vice-chairman; on Council Meetings, by Prof. M. L. Baker; on Students Guidance, by L. J. Archibald; on High School Students Guidance, by Prof. A. E. Flynn; and on the Special Course for Junior Engineers, by W. A. Devereaux.

The results of the election for 1952 officers were announced, as follows: chairman, J. W. MacDonald; executive, J. P. Dumaresq, V. Lodge, O. N. Mann, C. F. Cameron, J. K. Godfrey.

The retiring chairman, Mr. A. R. Harrington, read his report on the past year's activities. Attendances at monthly meetings have doubled those of the previous year, due probably to the new type of early buffet supper meeting. Emphasis on student guidance, and more interest in the junior engineer was attempted by the 1951 executive. Very good progress was made in both fields, and a Junior Engineer's course has already been organized and will start in approximately a month. Mr. Harrington stated that he felt these were good forward steps, since the aims of the Institute were not wholly social, and progress must be made in the future to develop the potential ability of the Branch to guide and assist student and junior engineers. Mr. Harrington reported that a Technical Committee under the Chairmanship of M. F. Dean was in active co-operation with the Halifax Civil Defence Organization.

J. W. MacDonald, the incoming chairman, took the chair and congratulated Mr. Harrington on presenting a report that revealed one of the most progressive years of the Branch. A vote of thanks was tendered Mr. Harrington by the meeting.

Eastern Townships

R. H. Blackmore, Jr.E.I.C.,
Secretary

Inaugural Meeting

On Friday evening, November 9th, the thirty-fifth Branch of the Engineering Institute of Canada was officially opened at Sherbrooke, Que. Approximately 165 members and their wives met for dinner at the Social Club to mark the occasion.

A welcome was extended on behalf of the City of Sherbrooke by Alderman Henri Labonne, representing His Worship Mayor Charles B. Howard. The President, Dr. Ira P. Macnab presented the charter of the new Eastern Townships Branch to Mr. George M. Dick, provisional chairman.

On behalf of the Montreal Branch, Chairman E. R. Smallhorn presented an Institute banner or pennant together with a cheque for one hundred dollars.

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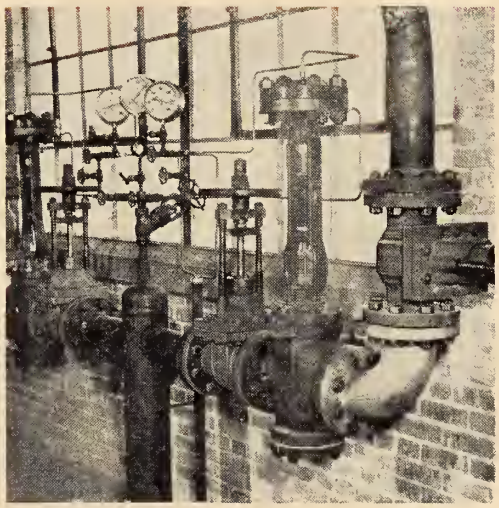

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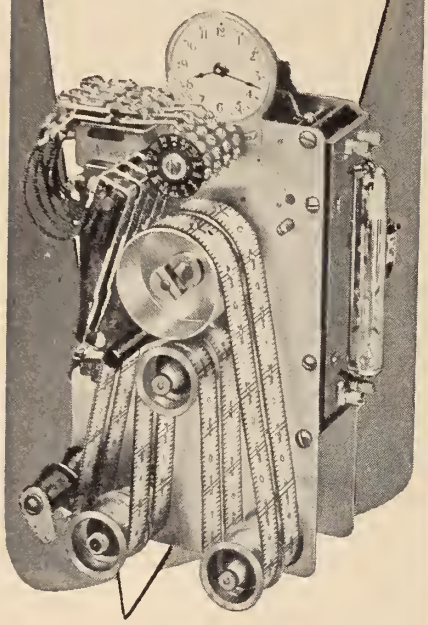

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Eastern Townships Branch

Top. Left to right: Mrs. Smallhorn, A. C. Crepeau, President Macnab, G. M. Dick, chairman; Mrs. Macnab, Mrs. Dick, and E. R. Smallhorn, the chairman of the Montreal Branch.

Centre. Left to right: Gaston Masse, A. C. Crepeau, President Macnab, G. M. Dick, and F. G. Ferrabee.

Bottom. Left to right: Roland Blackmore, G. M. Dick, Alderman Henri Labonne, H. Massue, R. L. Dunsmore, and R. E. Wotherspoon, secretary of the Montreal branch.

the Institute was represented by Vice-President and Mrs. J. B. Stirling of Montreal, Vice-President and Mrs. J. F. Wickenden of Three Rivers, Councillors W. E. Brown of Hamilton, and Donald and Mrs. Ross-Ross of Cornwall, Milton and Mrs. Eaton of Shawinigan Falls, Irving and Mrs. Tait, H. Gaudefroy, A. S. Rutherford, all of Montreal. Other visitors from Montreal were G. A. Gaherty, treasurer; Past Councillors Ralph and Mrs. Flitton, and Huet and Mrs. Massue; Dr L. Austin Wright, general secretary, Miss M. McLaren, assistant secretary, H. G. Thompson, assistant general secretary and E. J. Blandford, publications manager, all of the Institute Headquarters staff. The Montreal Branch was represented by Chairman and Mrs. E. R. Smallhorn, F. G. Ferabee, Mr. and Mrs. R. L. Dunsmore, Mr. and Mrs. Andre Benoit, Louis Trudel, G. N. Martin and Secretary-Treasurer R. B. Wotherspoon. The St. Maurice Valley Branch was represented by Secretary-Treasurer D. G. Demianiw as well as Councillor Eaton.

Provisional officers of the new Branch who were present included, besides Chairman Dick, Vice-Chairman Armand Crepeau, Secretary R. H. Blackmore, Treasurer L. G. Carignan and Committee members Gaston Masse, Bruce Bradley, J. C. Critchley, J. A. Dickenson, T. W. Houghton and D. K. Sherry.

The principal speakers, President Macnab and General Secretary Wright, were introduced by Vice-Chairman A. G. Crepeau. President Macnab reviewed the progress of engineering throughout the ages and its culmination in the developments of the past fifty years. He then went on to stress the possibilities opened up by the development of atomic energy. Dr. Macnab also emphasized the responsibility of the engineer to his fellow-citizen, particularly in providing leadership to government and other agencies engaged in public service. The general secretary, Dr. L. Austin Wright reviewed the activities of the Institute and gave the members of the new branch a brief outline of its varied interests on behalf of the engineering profession in Canada. The speakers were thanked by J. A. Dickenson of East Angus, a member of the local executive.

F. G. Ferabee of Montreal, general manager of the Canadian Ingersoll Rand Co. Ltd., spoke briefly on behalf of the industries in the Eastern Townships, felicitating the Institute members on the establishment of the new Branch and pointing out the value of such an organization to industrial progress. Vice-President J. B. Stirling also added a word of congratulations to the new Branch, wishing it success for the future.

Council Meeting

The inauguration of the Eastern Townships Branch was followed by a regional meeting of Council held at the New Sherbrooke Hotel on Saturday, November 10th. In accordance with usual practice, all members of the local branch executive as well as many out of town visitors were invited to attend and to take part in the discussions. The meeting convened at 9.30 a.m. and adjourned at 1.00 p.m.

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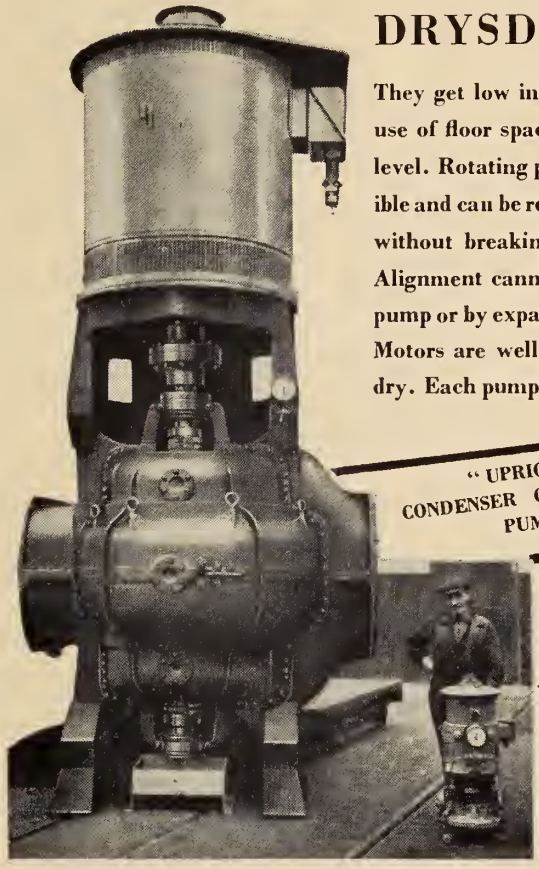

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Hamilton

G. L. Schneider, Jr.E.I.C., *Secretary-Treasurer*

B. A. Warren, S.E.I.C., *Branch News Editor*

Engineers' Ball

The highlight of the season's programme for the Hamilton Branch was the second Annual Engineer's Ball. It was held on November 22 at the Brant Inn, Burlington, Ont., and more than 300 persons danced to the music of the R.C.A.F. Reserve Dance Orchestra whose programme featured novelty and spot dances with prizes, along with well supported Paul Jones numbers.

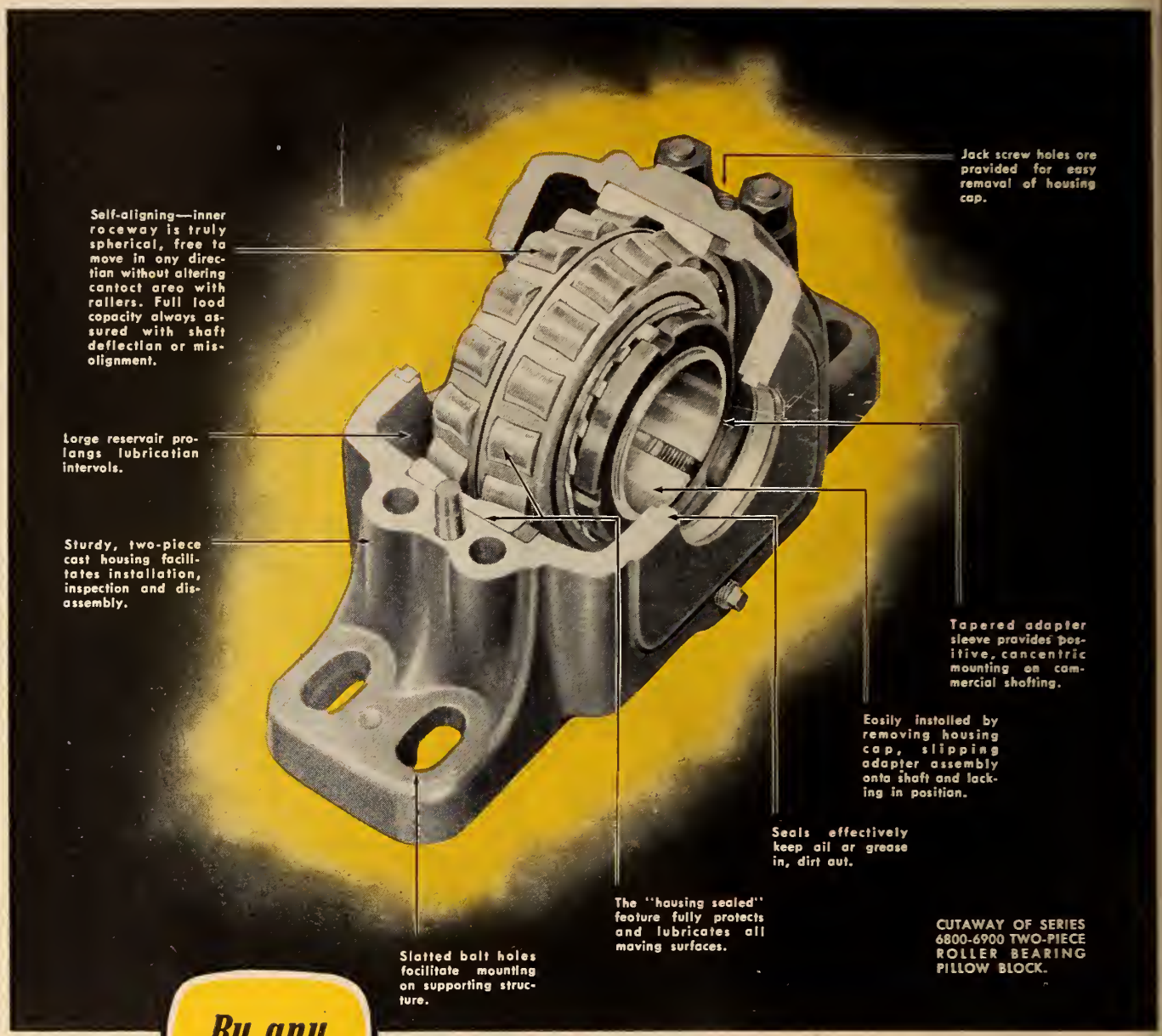
At one intermission, a lugubrious group of four presented a short programme of quartet music. The four were John Mitchell, M.E.I.C., Lloyd Mainprize, S.E.I.C., Dick Ward, Jr.E.I.C., and Barney Warren, S.E.I.C. The second intermission featured Mr. Ward with a piano and vocal routine, the crowd joining in on the choruses of several numbers with considerable gusto.

Able chairman of the Ball Committee was Mr. G. L. Schneider, vice-chairman was Mr. W. A. Whetan, and Mr. Ian Macdonald was in charge of entertainment.

Through the efforts of Mr. J. A. Reid and Mr. Stan Glover, an excellent art exhibit, consisting of salon photos, colour slides and paintings, all by members of the Branch, was featured on the upper deck of the Brant Inn.

Before the dance, 80 persons took advantage of a splendid dinner arranged for members of the Branch and their ladies.

Seated at the head table were E.I.C.



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Vice-President and Mrs. C. G. R. Armstrong; A.P.E.O. President and Mrs. W. H. M. Laughlin; Branch Chairman and Mrs. E. T. W. Bailey; Chairman of the Engineers' Wives Association Mrs. G. L. Schneider and Mr. Schneider, secretary treasurer of the Hamilton Branch, and Ball Committee Chairman.

Mr. Laughlin of Toronto spoke briefly, bringing greetings of the Ontario Association of Professional Engineers.

Mr. Armstrong of Windsor spoke to the dinner meeting bringing greetings from the president and praising the activities of the Hamilton Branch, stressing those of the Students and Juniors. A highlight of the evening was the presentation by Mr. Armstrong of certificates to winners of last season's Juniors' and Students' Papers Competition. Mr. Cam Layard received the first prize, and Mr. Robin Beck the third prize. Mr. Don Urquhart, winner of the second prize, was not on hand to receive his certificate, having recently been moved to Winnipeg.

Illustrating the theory that those who offer to do a little work always are asked for more, Mr. Beck is the chairman for the Committee on Juniors' and Students' Papers for the coming year, and Mr. Layard is the man responsible for organizing the already highly successful Juniors' and Students' Course in Professional Development.

Among those patrons who spoke at the dinner were E.I.C. Past-President James Vance, and E.I.C. Field Secretary Col. L. F. Grant. Other patrons for the ball were Mr. and Mrs. F. A. Sherman. Mr. F. I. Ker, Mr. and Mrs. W. E. Brown, and Mr. and Mrs. C. C. Parker.

Also serving on the Ball and Dinner Committee were Messrs. J. B. Carruthers, programme; H. Hillgartner, treasurer; E. W. Hill, decorations; and B. A. Warren, publicity.

The general opinion of those in attendance was that the evening was an extremely successful one and truly a big night in the Hamilton Branch activities.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

J. T. Dokken, Jr.E.I.C.
Branch News Editor

Annual Joint Dinner

The annual dinner meeting of the Association of Professional Engineers of Alberta and the Lethbridge Branch of the Engineering Institute was held on Friday, November 17th, 1951, at the Marquis Hotel. Mr. Harold Randle, president of the A.P.E.A., presided as chairman. Mayor L. S. Turcotte, on behalf of the city welcomed 85 engineers from various points in Alberta.

Dinner music was supplied by the Brown Instrumental Trio followed by vocal selections by Mrs. C. Lloyd, concertina selections by Mr. R. Wolstencroft and community singing ably led by R. S. Lawrence.

Mr. John Clarke, M.E.I.C., of Calgary, Alberta, district sales manager for the Canada Cement Company, gave an interesting talk on the "History of Portland Cement Concrete and Some Recent Developments in Same."

Concrete today is one of the most essential building materials in the life of the average citizen, being used extensively for bridges, roads, power houses, dams, canals and dwellings.

It can be easily moulded to any desired shape and have almost any desired compressive strength.

Prehistoric man filled the cracks in his primitive dwelling with mud. Eventually it was found that more resistance to the elements could be obtained by tamping mud into forms or using sun dried bricks. Later it was discovered that oft burned limestone in fireplaces, combined with water, formed a paste which, after drying, became a hard impervious material. This lime is the direct ancestor of Portland cement.

Lime mortar was next developed near Rome with the use of volcanic ash. Thick walls were used as reinforcing was unknown. This Roman concrete, contrary to belief, was not nearly as strong as present day concrete.

In 1824 Joseph Aspden of Leeds, England, first discovered what is now known as Portland cement. He found that by burning pure limestone with about 25 per cent clay at a higher temperature than previously used he obtained a better product. He named it Portland cement, as it resembled a rock quarried at Portland, England.

Portland cement today is primarily the same as that patented by Aspden but methods of manufacture have improved and much higher strengths are now attainable. To make a barrel of cement weighing 350 pounds, 560 pounds of stone and shale and 60 to 70 pounds of coal are required.

Until 1910 concrete was placed by the "dry-tamped" method and after that date there was a tendency to "pour" a very sloppy mixture. In 1918 Duff Abrams, of Chicago, discovered that strength and durability varied inversely with the ratio of water to cement. This is known as the water-cement ratio law.

It was later discovered that richer mixes were necessary to avoid disintegration in alkali regions. A Canada Cement Company chemist used a shale of higher silicon and iron content and lower alumina content and thereby discovered Kalicrete, a highly alkali-resistant cement which is of prime importance on irrigation works in the Lethbridge district.

Air entrainment in concrete was a very significant discovery. An emulsion placed in the mix leaves minute, detached air bubbles throughout the mass acting as a flexible aggregate. This improves the workability of concrete, allows a reduction in the sand content preventing bleeding, and greatly decreases the damaging effect of freeze-thaw cycles.

In conclusion Mr. Clarke stated that good concrete is easier and cheaper to make than bad. Merely use a clean sand, select a good stone and choose a water-cement ratio both for strength and durability.

After his talk Mr. Clarke showed films covering the procedure of cement manufacture.

Prof. R. M. Hardy, dean of engineering at the University of Alberta, expressed a vote of thanks to Mr. Clarke on behalf of all present, for his well planned and enjoyable paper.

Moncton

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

R. A. Park, M.E.I.C.
Branch News Editor

Supper Meeting, November 22

Public health engineering was defined as the application of skill and experience in the prevention of disease, by S. E. Menzies, M.E.I.C., chief of the public health engineering division of the Department of National Health and Welfare.

He addressed a supper meeting of the Moncton Branch, on November 22, at Cy's Sea Food Bar. E. M. Nason, chairman of the local branch, presided and introduced Mr. Menzies.

The speaker told of some of the methods of transmission and control of disease, and said a great deal of work has been done toward controlling the water supplies of ships, trains, and planes by the Department of Public Health and Welfare in co-operation with the departments concerned.

In these days of modern communication, said Mr. Menzies, the source of supply of water is not always constant, often resulting in a sanitation problem.

Mr. Menzies said that as recently as 1923 typhoid fever was rampant among the crews of the Great Lakes ships because they were using polluted lake water for all purposes without any thought of purification, but this condition has since been radically rectified.

Sewage disposal, according to Mr. Menzies, is another very important task over which the department must keep the strictest control. In the Yukon and Northwest Territories perma-frost presents the greatest problem to sewage disposal. The important problem of sewage disposal along railway right of ways is being dealt with also, with co-operation of the railways.

The Department of Public Health and Welfare in co-operation with the Department of Defence is currently making a study of radio-active wastes. Four engineers from Canada have taken special courses recently in Cincinnati. In the event of a war this knowledge will be highly valuable and all engineers will have to do a great deal more in this field in the event of emergency.

Mr. Menzies gave comprehensive remarks on the water supply and sanitation of national parks, government offices, hospitals and boundary waters. Air pollution and adequate lighting were also touched upon, and those engineers not working directly with the department were greatly enlightened in connection with the work being carried on.

Mr. Menzies is a graduate of Toronto University and recently gave a paper on air pollution to the American Public Health Association in San Francisco.

Guests at the meeting included L. Belleville, Department of National Health and Welfare, Montreal; C. H. Gibson, T.C.A., Moncton; J. B. Christie of George Hardy Co., Ltd., Toronto; J. Young, Armco Co., Saint John; J. Brown, Maritime Central Airways, Moncton; and R. E. Tait, Department of National Health and Welfare, Moncton.

Montreal

R. B. Wotherspoon, M.E.I.C.,
Secretary-Treasurer

Joint Meeting, December 4

More effective use of personnel offers the best prospect of increasing productivity in industry, A. R. Stewart, assistant manager, industrial relations department, Canadian Industries Limited, told a joint meeting of the Engineering Institute of Canada and the Canadian

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It must be good to stand up under the operating conditions of a modern sanitary sewer.

VITRIFIED CLAY PIPE INDUSTRY

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Industrial Trainers' Association on December 4.

Mr. Stewart spoke on "Management's Responsibility for Training." The joint meeting was held at headquarters of the Institute.

"Most of us will agree that the owner of a big league ball club would be foolish if he expected to win a pennant with a bunch of ball players who never practised, and if he had no coach, no farm clubs, or scouts out looking for new talent.

"Yet there are many managements trying to run their companies without a thorough personnel training programme, without a fully qualified training director, and making no effort to attract and hold good men."

Mr. Stewart said that training of personnel is necessary for the economic survival of a company.

"Management's prime responsibility is to perpetuate the company as a profitable enterprise for the owners. To do this management must assure itself of a continuing supply of well qualified men to fill all positions in the company. The experience and know-how possessed by employees is one of the most valuable assets of any company."

Other good reasons for a continuing programme of personnel training, he added, were the current shortage of trained personnel, increased specialization within industry, and the growing demand of workers and lower management for participation in the development of policy.

"We should provide an opportunity for each employee to develop to the limit of his ability."

A continuing programme of personnel training, he added, gives workers a greater sense of job security, a chance to advance, better leadership, and a feeling of belonging. It also gives workers an appreciation of accident, sickness and retirement benefits, and pride in the company.

The company, Mr. Stewart said, gets from a personnel training programme better management, increased production, higher quality, lower costs, fewer accidents, reduced labour turnover, and more suggestions from employees for improvements.

The company also receives intangible values, such as better morale, better understanding of policies, better union-management relations, and better communications between employees and management, he added.

Mr. Stewart stressed that personnel training programmes must be on a continuing basis, and that all levels of supervision must participate.

"The downfall of many training programmes has been the lack of follow-up." Refresher and follow-up sessions should be part of training courses.

Lower St. Lawrence

JEAN R. MENARD, M.E.I.C.
Secretary

Inaugural Meeting, October 12

October 12, 1951, marked the occasion of the inaugural meeting of The Lower St. Lawrence Branch which was held at the Hotel St. Louis in Rimouski, Que.

The president, Dr. I. P. Macnab, accompanied by Vice-President J. F. Wickenden of Three Rivers, with their wives, General Secretary Dr. L. Austin Wright and a party of councillors as well as other prominent members from Montreal and Quebec, arrived in the morning and met members of the provisional executive of the Branch, L. G. McLaren, chairman, T. A. Bernier, vice-chairman, J. R. Menard, secretary-treasurer, and others.

In the afternoon, a visit was paid to the site of the landslide along the Rimouski river and to the section of the town destroyed by last year's fire. At the conclusion of the visits, the entire party were guests of His Worship Mayor Le Page, the aldermen and other civic officials at a reception held in the City Hall.

The actual inauguration took place at the dinner held at the Hotel St. Louis commencing at 7 p.m. Many distinguished local guests were present in addition to the Institute officials and visitors from Quebec, Three Rivers and Montreal. These included His Worship Mayor Le Page, Mr. Gagnon, O.B.E., director of the Technical School, representing His Excellency Mgr. Parent, Archbishop of Rimouski; Mr. R. Levesque, M.L.A. for Gaspe North and many others. Institute members from Quebec included J. Saint Jacques, Branch chairman, R. Desjardins, secretary-treasurer, M. Ostiguy, member of the executive and O. Martineau, councillor. The Montreal Branch was represented by E. R. Smallhorn, chairman, and Councillors L. A. Duchastel and Prof. H. Gaudefroy. Councillor L. P. Dancose of Mont Joli was also present for the occasion. Other members of the provisional executive present were A. Bellevance, M. Lanouette and A. Michaud. The president, Dr. I. P. Macnab, was the principal speaker and presented the Charter for the new Branch to Mr. L.

Lower St. Lawrence Branch

Upper. Left to right: Mrs. Macnab, L. G. McLaren, President Macnab, and Mrs. McLaren.

Lower. Rimouski residents and visitors from Montreal and Quebec enjoy the social hour.

G. McLaren, chairman of the provisional Branch executive. Following the president, Dr. L. Austin Wright, general secretary, spoke at some length concerning the Institute and its many activities on behalf of the engineering profession in Canada.

On the following day, Saturday, October 13, a regional meeting of Council was held at the Hotel St. Louis in Rimouski. All members of the local executive as well as out-of-town visitors attending the opening were invited to be present and to take part in the discussions.

December Meeting

The next meeting of the new Branch took place on Tuesday, December 11. H. Cimon, vice-president of Price Bros. Company Limited, addressed the members of the Branch at a dinner meeting. Mr. Cimon outlined the progress of the organization of professional engineers throughout Canada from the early days when railroad construction was our principal engineering activity, up to the present. Following Mr. Cimon's talk, a film was shown describing the landing of the Allied troops on the Normandy beaches.

Newfoundland

B. E. Higgins, jr.e.i.c.,
Secretary

R. P. Hant, jr.e.i.c.,
Branch News Editor

Presidential Visit, September

On Wednesday, September 19, 1951, the Newfoundland Branch were hosts, at Woodstock Country Club, to the President of the E.I.C., who arrived in St. John's that day for a two-day visit.

The presidential party comprised: Dr. Macnab and Mrs. Macnab, Vice-President J. B. Stirling and Mrs. Stirling, and Dr. L. Austin Wright, general secretary. Local guests included: Hon. O. L. Vardy representing the Newfoundland government, and His Honor Mayor Mews, representing the City of St. John's. The chairman for the evening was Mr. E. A. Monkman, the Branch chairman.

Dr. Macnab congratulated the Newfoundland Branch on the great strides it had made in the two years since it was organized. He said that the engineering profession plays an important role in modern civilization. He warned that as we enter an "Atomic Age," the engineers of the world carry a tremendous responsibility. He said we have been so interested in designing and building that we have not stopped to think of the results. He urged engineers to keep before them their civic responsibility and to take full advantage of the opportunity being afforded them to study the broader aspects of life when they had completed their technical training.

Dr. Wright, addressing the meeting, asked his colleagues to give serious consideration to the Government's proposed programme of engaging qualified engineers from Europe. He had recently returned from Europe where he had been sent to interview and screen prospective personnel to fill the urgent requirements in Canada's engineering fields. He pointed out that there was no fear of the Europeans causing a shortage of jobs for Canadian engineers in the Dominion as every facet of present day civilization depends upon engineering skill.

During the evening addresses were also given by Hon. O. L. Vardy and by Mayor Mews.

The next day an executive meeting was held, after which the presidential party left for Corner Brook, where meetings took place with members of the Institute at the West Coast paper town.

Business Meeting, October

At a meeting on Friday evening, October 19, at the Memorial University in St. John's, the chairman, Mr. B. A. Monkman, presided.

The financial statement was read by the treasurer. It was decided to advance the date of the annual meeting from June to the first two weeks in May, as it was felt that by June a considerable number of members would be out of town. The chairman addressed the meeting briefly and touched on various matters which had been raised during the President's visit. He outlined the views of the Executive Committee as expressed during their visit here regarding an increase in Institute fees, and a general discussion followed. A vote of hands showed that it was the feeling of the Branch that there should be an increase in the fees of corporate members only.

It was decided to hold the monthly meetings of the Branch on the second Monday in every month. A suggestion was made that the Branch should join the St. John's Film Council; the Programme Committee was authorized to look into this, as well as the possibility of holding a dance some time in November.

The chairman reported that several wives of members had suggested the

formation of a Ladies' Organization of the Branch. The members felt that a Ladies' Oganization could make a real contribution to the progress of the Branch.

November Meeting

A meeting of the Newfoundland Branch was held on November 13, at Memorial University, with Mr. B. A. Monkman, M.E.I.C., in the chair.

After a short business meeting the chairman called on Mr. S. J. Carew, M.E.I.C., Professor of Engineering at Memorial University, to introduce the speaker of the evening—Mr. Claude K. Howse, Government geologist.

Mr. Howse, discussing "The Iron Ore Development in Labrador," outlined the discovery of the iron deposits, their development since 1936, and the terrific obstacles which had to be overcome before it was decided that it was economically feasible to go ahead with the development. The fact that these obstacles had been overcome and the way in which the project was actually progressing were a tribute to the engineering profession, he said.

Mr. Howse went on to describe some of the engineering projects that had to be carried out before the iron ore could be brought to Seven Islands, from which it would be shipped to the steel producing centres. The biggest undertaking was, perhaps, the building of the railroad from the ore bodies south to Seven Islands. This involved the building of air strips, the transportation of huge quantities of materials, from gasoline to bulldozers, by air.

At the conclusion of his talk Mr Howse showed some photographs and coloured slides of the development, which helped the members to visualize more clearly the immensity of this project.

A hearty vote of thanks was proposed to Mr. Howse by Mr. Grant Jack, M.E.I.C., on behalf of the members. Before the meeting adjourned, coffee and sandwiches were served.

Niagara Peninsula

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

John S. Ellis, Jr.E.I.C.
News Editor

Tour of H.E.P.C. Development

As guests of the Ontario Hydro, more than one hundred members of the Branch participated in a well organized tour of the Sir Adam Beck No. 3 Development, Queenston, which is now under construction. The programme consisted of an introductory film, a talk outlining the route, the tour, dinner, and an illustrated address.

The film, entitled "Niagara the Powerful," gave the audience an overall picture of the existing hydro-electric developments in the Niagara region and was outstanding for some of its excellent scenic views. At the conclusion of the film, Mr. W. M. Hogg, assistant field project engineer, outlined the route which was to be followed in touring the development, in this way helping the group to anticipate points of interest.

The tour commenced at the excavation for the penstocks and powerhouse which was being carried out in the 300 foot bank of the Niagara River. The members were then taken by bus from forebay to intake along the route of the canal and tunnel. The excavation of the forebay and rectangular canal was well under way and work was progressing on a trapezoidal section immediately upstream from the rectangular canal. Four vertical shafts of the tunnel had been excavated to approximately one half their total depths and at Shaft Number 1 the group left the buses to inspect the work more closely. No work had commenced on the intake but its location was visited before the buses conveyed the members to the dining hall of Camp No. 2.

After a very fine steak dinner, the group was addressed by Mr. Gordon Mitchell, project manager, who gave his audience a comprehensive idea of the major parts of the development and he lucidly explained many of the factors which govern its construction. He emphasized the great value of the hydraulic model studies which have resulted in considerable savings and he drew an interesting comparison between the gatehouse and powerhouse designs of the existing and new Queenston Developments. Mr. Mitchell remarked on the decisions concerning the location and size of camps, location of shops and concrete plants, sources of coarse and fine aggregates, location of disposal areas, construction of roads, staff accommodation and the hospital. He mentioned the equipment on hand and concluded his address by showing relevant slides and a film on the hydraulic models. An informal question and answer period followed the film, and Mr. Mitchell and his associates received a hearty vote of thanks from the members.

Plant Visit, St. Catharines

Over sixty members of the Branch responded to the generous invitation of the St. Catharines Water Works Commission to visit their filtration plant, and to hear Dr. A. E. Berry, director of the Sanitary Engineering Division, Ontario Department of Health, speak on the subject of "Modern Water Treatment."

The members were welcomed by Mr. A. W. Horton, past chairman of the commission, and the speaker was introduced by Mr. A. L. McPhail, M.E.I.C., superintendent of the commission. Dr. Berry stressed the role that good water supply plays in attracting industries and stated that governments in both Canada and the United States give priority to the development of water purification plants. He gave the interesting statistics that over eleven billion dollars are invested in this continent in water supply systems, which require a total staff of about 100,000. The speaker reviewed the contribution which engineers have made to the field of water treatment and outlined the history of the early infiltration systems, the slow sand filtration plants, the modern rapid sand filtration plants and the present day chlorination of water. He referred to the modern use of anthracite coal as a filtering agent, to the increased efficiency due to prechlorination, and to the experiments regarding fluorination to combat tooth decay. In concluding, Dr. Berry listed problems which currently face those connected with water treatment: the conservation of water, the distribution of water to inland places, and the pollution of water sources. The speaker received a hearty vote of thanks on the motion of Mr. M. Ker, M.E.I.C.

After the address the members were shown the back wash procedure used in cleaning a filter and were conducted around the plant to the chlorination room, pump room, pipe gallery and other points of interest. Following this tour a film was shown which illustrated Dr. Berry's lecture. Refreshments were served and Mr. J. Miller, M.E.I.C., concluded this fine meeting by expessing the membes' appeciation to the St. Catharines Water Works Commission.

Peterborough

J. P. Watts, M.E.I.C.,
Secretary-Treasurer

M. V. Powell, M.E.I.C.,
Branch News Editor

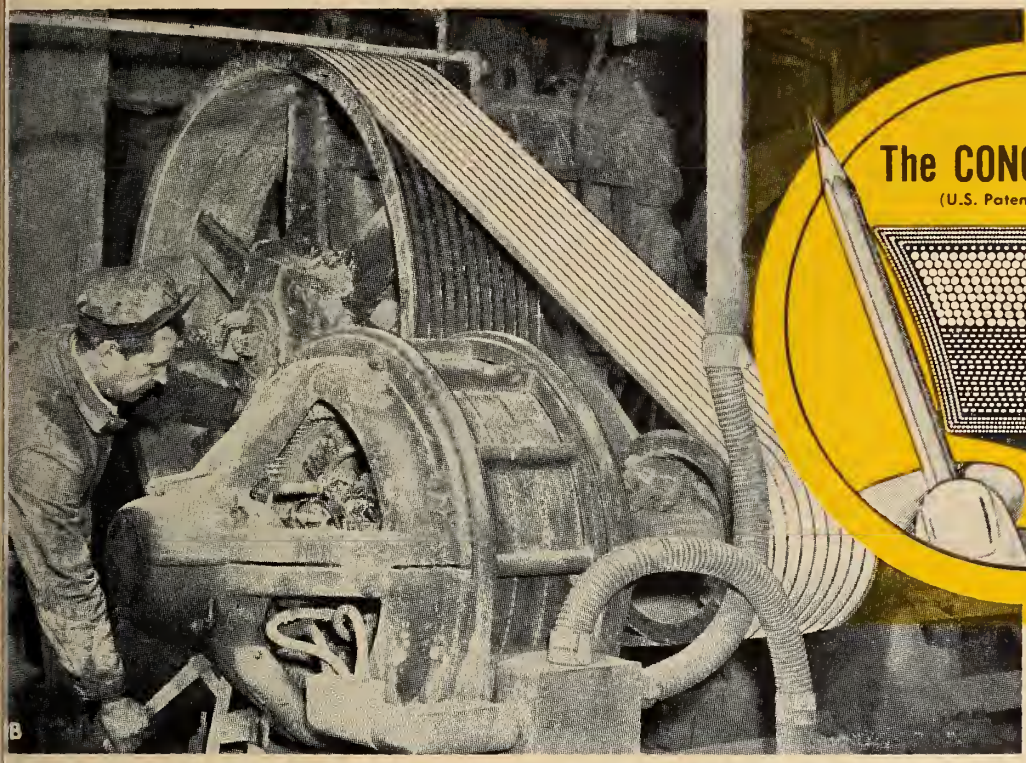
December Meeting

Mr. R. A. H. Hayes of H. G. Acres and Company addressed the Peterborough Branch, Thursday, December 13, on "Design Trends—Modern Hydro-Electric Plants". Mr. H. R. Sills introduced the speaker and mentioned that after graduating from McGill he had worked on power projects all across Canada.

With lantern slides, Mr. Hayes traced the development of waterwheels from the first primitive ones of ancient times to the Francis and propeller types of the latest power plants. The more important details, such as wicket gates, shift rings and hydraulic servo-motors were briefly touched on.

He then outlined the evolution of the generator from the machines built at the turn of the century to modern vertical units. The early machines had horizontal shafts but as capacities increased vertical shaft machines became common with free ventilation and spider type upper brackets carrying thrust and guide bearings on top. The air was commonly taken in at the turbine floor and blown out through the stator. In the late twenties or early thirties a great reduction in shaft length and powerhouse height was made by the introduction of surface air coolers and also by lowering the bearing oil pots into the hubs of the upper brackets. At present, it is common practice to allow only the exciter to show above the operating floor, the generator being housed in a masonry compartment made easily accessible by removable hatch covers. This is a great change from the old Toronto Power Plant above Niagara Falls with its generators at ground level and its turbines on vertical shafts over 100 feet below. The latest designs now call for the powerhouse roof to be located just above the exciter and a gantry crane to serve the generator and turbine through hatch openings in the roof. Emergency repairs are now seldom necessary as modern waterwheels do not suffer from cavitation to any extent and generator repairs can ordinarily be done without removing any large parts.

Proposed new small plants based on European designs will probably in the near future assume a different design with turbine above the forebay level depending upon a siphon effect to maintain flow. This will avoid much costly excavation and allow bringing up the machine to synchronous speed by a squirrel cage winding powered from the electric system before water



This 36"x 42" jaw crusher of Canadian Quarries, Ltd., Montreal, Quebec, used to be driven by a double reduction flat belt drive. Mr. Pierre Manseau, Master Mechanic, says that the Gates Vulco Rope Drive shown, "has reduced our maintenance costs by about $1000 per year and we were also able to increase production by fifty tons per hour."

This test shows how the Concave Side gives you a real saving in V-Belt costs

If you are interested in lower operating costs, make this simple test:—

Take any V-belt and bend it as it bends in going around a pulley. As the belt bends, grip its sides with your fingers and thumb. You will *feel* the sides of the belt *bulge out!*

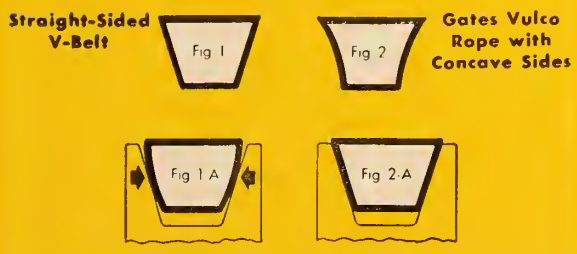
This bulging gives a straight-sided V-belt the shape shown in figure 1-A. (See diagrams at right.) Clearly, this shape does not fit the sheave groove. The sides of the bulging belt are forced to press unevenly against the V-pulley—and this concentrates the wear along the *middle* of the sides.

But when you bend a V-belt that is built with the *Concave Side,* you find that the sides become perfectly straight—as shown in Figure 2-A. This shape precisely fits the sheave groove.

Because there is *no bulging,* the sides of the Gates Vulco Rope always grip the *full* face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

Only V-belts made by Gates are built with concave sides. Whenever you buy V-belts, be sure you get the V-belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

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is in the turbine. The siphon will then be started by a venturi ejector. Expensive governor mechanism, synchronizing devices and possibly even a voltage regulator may not be required and in case of emergency only a device to break the siphon will instantly stop the machine.

The meeting was very well attended. Mr. D. A. Drynan moved a vote of thanks, and Mr. Frank Pope was chairman.

Saint John

W. M. Brennan, M.E.I.C.,
Secretary-Treasurer

S. V. Grisdale, M.E.I.C.,
Branch News Editor

Meeting At Fredericton

A meeting of the Saint John Branch of the Engineering Institute of Canada was held in the Lord Beaverbrook Hotel on October 18. Mr. W. R. Godfrey acted as chairman of the meeting. Among the head table guests were Messrs. Tweeddale, Reed, Turner, Monti, Brewer, Armstrong, Weyman, Watt, Webb and Brennan.

Mr. D. J. Brewer announced the results of 101 questionnaires which had been sent out to members who reside in Fredericton and vicinity, asking for expressions of opinion on the formation of a separate branch of the E.I.C. at Fredericton. Fifty-one replies were received in favour of formation of a new branch and a canvass of those not replying in writing brought the total to 83 favourable opinions. It was therefore decided to go ahead with the formation of the Fredericton branch and a meeting was called for October 26 for the purpose of electing provisional officers.

Mr. Andrew Watt proposed a toast to the new branch at Fredericton and this was replied to by Dr. E. O. Turner.

The speaker of the evening was Dr. T. A. Monti, district engineer of the Canadian Institute of Steel Construction, who discussed "Modern Steel Fireproof Construction". Dr. Monti was introduced by Mr. John Reed, chief engineer of the St. John Drydock Company Limited.

Dr. Monti compared the frame of walls of a modern multi-storied building to the skin and bones of the human body. The principal object of the frame is to carry the live loads of the floors, but it must also carry its own weight and, for high buildings, the weight of the walls. Steel is an ideal building material because of its low weight-to-strength ratio and good rigidity. Fireproofing is obtained also with low weight by using such materials as vermiculite, perlite, expanded shale, etc., which are light and have high insulation values.

Dr. Monti stated it to be illogical to use heavy walls having very high fire ratings, perforating them with a multitude of windows for which the fire value is very low. Light fabricated curtain walls having a fire rating of about 2 hours, and capable of taking the wind pressure, are being fabricated of different materials such as metals, concrete, porcelain, etc., and backed by a light-weight high value insulation. The walls are thereby made thin and light and the dead load is considerably diminished and the rentable floor area is increased.

Dr. Monti mentioned that progress in construction methods is often slowed down by the over-conservative building by-laws and cited as an example the fact that certain cities consider flat slab construction more fire resistant than protected joist floor panels, even though the U.S. Bureau of Standards has shown by experiment that the reverse is true. He made reference to the Rimouski fire where two flat slab buildings were seriously damaged, while the joist panel type of building came through almost unscathed.

Dr. Monti concluded with the remark that modern building construction is gradually tending toward the increased use of light materials and the curtain walls which, combined with the low-weight welded steel frames of high rigidity, are permitting the quicker construction of more economical buildings.

Sudbury

W. S. Black, M.E.I.C.,
Secretary-Treasurer

D. W. McKinty, Jr.E.I.C.,
Branch News Editor

Dinner Meeting

At a general dinner meeting of the Sudbury Branch on December 6, 1951, there was a very large turnout with some members travelling from as far as North Bay.

After dinner, entertainment was provided by a Croation orchestral group, whose renditions of both national and popular songs were very well received.

E. H. Jones presented a report on the civil defence organization, outlining the role which the engineer is expected to play in the defence set-up.

W. B. Ibbotson announced that Dr. Brunton of Isotopes Products Limited would speak at the next meeting, January 10.

A vote of appreciation was made to Russ Eaton and John Quance who ran for public office in the civic elections of December 3.

J. S. Cooper introduced the guest speaker for the evening, J. W. Millar, M.E.I.C., chief mechanical engineer for the Ontario Northland Railway. Mr. Cooper pointed out the long association with railroading of Mr. Millar who started with the C.P.R. as an apprentice in 1923.

Mr. Millar had chosen for his topic "Steam Locomotives vs. Diesel-Electric Locomotives" and he presented his subject in such a way as to make it interesting to all present. He traced the development of both types of locomotives from their beginnings, comparing them from standpoints of operating and maintenance. He expressed the opinion that the diesel-electric would prove to be far more economical when operating and maintenance crews were trained to get the most from them.

In conclusion he outlined the work which is being done to produce a practical coal or oil burning gas turbine locomotive and stated that the diesel-electric may not be the ultimate in economical railway locomotion.

W. B. Ibbotson thanked Mr. Millar on behalf of the branch and assured him that after such an interesting presentation his audience felt like genuine "ferro-equinologists".

Vancouver Island

W. Bowman, M.E.I.C.
Secretary-Treasurer

G. J. A. Kidd, Jr.E.I.C.
Branch News Editor

October Meeting

The monthly meetings of the Vancouver Island Branch commenced for the 1951-52 winter season in the reading room of the Provincial Library of the Parliament Buildings on October 17 with approximately 40 members in attendance. Before calling on the guest speaker a short discussion was held to ascertain the feelings of the members concerning the advisability of holding joint meetings with the B.C. Engineering Society. It was agreed to invite the B.C. Engineering Society to share the Branch's monthly meetings.

The guest speaker for the evening was Leonard G. Hatcher, civil defence co-ordinator for the City of Victoria who addressed the gathering on "The Engineer's Position in Civil Defence." Mr. Hatcher has had considerable experience in civil defence work, having served as assistant superintendent of transport in London, England, during the last war. Mr. Hatcher explained that the engineer plays a very important part in all phases of civil defence and during the last war worked closely with all types of engineers.

The main theme of civil defence co-ordination, Mr. Hatcher said, is to plan before a war, while thinking is still sound. It is important to outline a plan beforehand, and lay out an organization which could take control at a moment's notice. This organization, as Mr. Hatcher has planned it for the City of Victoria, consists of several planning committees, each committee under the leadership of an expert. These committees are as follows: Transport, Public Utilities, Shelter Feeding and Welfare, Medical, Police and Fire, Engineering, Industry, Accounts and Supply, Armed Service and R.C.M.P., Communications, and Red Cross. Each of these planning committees would work on its own under the guidance of the civil defence co-ordinator.

If war should break out an operational organization would be required. This, Mr. Hatcher explained, would consist of a main control which would include the chiefs of the following groups: Intelligence, Signals, Engineering, Medical, Transport and Public Utilities, and Services Liaison. Near this main control would be a reserve depot which could become in case of necessity the alternate main control. Branching out from main control would be subdivisional headquarters where there would be officers and reserve teams in each district corresponding to each division of main control. There would be pioneer, salvage, rescue, repair, signal maintenance, ambulance, reconnaissance and food teams. Each

subdivision would be further divided into 8 or 10 sections, each section in charge of a warden.

Mr. Hatcher, in conclusion, listed the three objects of a civil defence programme: (1) to make the people want to go on, (2) to organize to render aid, (3) to restore the city to some degree of working order. In all phases the engineer plays a vital part.

Winnipeg

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

G. W. Moule, M.E.I.C.
Assistant Secretary

Joint Meeting

On November 29, D. W. Miller, resident engineer for H. G. Acres & Co., spoke before the regular joint meeting of the Winnipeg Branch and the Association of Professional Engineers of Manitoba. The subject was "Pine Falls Power Development, Investigation of the Site and Methods of Coffer Dam Utilization and Construction."

He traced the development of the project from its beginning up to its present status, amply illustrating his address with slides and a film. In spite of the difficulties encountered, especially the flooding of the Winnipeg River in the spring of 1950, the first generator will be in service within a month of the original prediction. The speaker was introduced by J. R. Rettie, and thanked on behalf of the meeting by H. J. A. Bird.

At this meeting T. H. Kirby, councillor for the Winnipeg Branch, presented the framed certificate for the E.I.C. Prize to D. A. Young, fourth year engineering student at the University of Manitoba. Mr. Young was secretary of the Student Section of the Winnipeg Branch in 1950-51, and is now senior stick of the Engineering Undergraduate Society.

Chairman of the meeting was C. L. Fisher vice-chairman of the Winnipeg Branch, and vice-president of the Association of Professional Engineers.

Electrical Section

J. G. Dickinson, Jr.E.I.C.,
News Editor

Annual Dinner and Dance

The Electrical Section's very successful annual dinner and dance was held in the Blue Room at the Marlborough Hotel, Winnipeg, November 23.

Dean G. P. R. Tallin of the College of Law, University of Manitoba, gave an extremely entertaining after-dinner talk, which was something along the lines of "Men and Their Encumbrances". Dean Tallin was very capably introduced by Mr. E. M. Scott. The chairman was Mr. L. A. Bateman.

Head table guests, besides Mr. Bateman, Mr. Scott and Dean Tallin, were Mrs. Tallin and Mrs. Bateman, Miss Beryl Falloon, Dean and Mrs. A. E. MacDonald, Faculty of Engineering, University of Manitoba, Dr. and Mrs. E. P. Fetherstonhaugh, Mr. W. D. Hurst, city engineer of Winnipeg, and Mrs. Hurst.

Coming Events

January 10, 1952, Mr. D. J. Watson—Northern Electric Co. Ltd. "Transistor Development".

February 7, 1952, Mr. Baumann—Canadian Westinghouse Co., Ltd. "Gas Turbines".

March 6, 1952, Mr. W. Ward—Canadian General Electric Co. Ltd. "This Electronic Age".

April 3, 1952, Mr. R. A. Moore—English Electric Co. of Canada Ltd. "Air Blast Circuit Breakers".

May 1, 1952, Mr. T. H. Woodhall—Manitoba Power Commission. "Discussion Manitoba Power Commission System".

December Meeting

Members of the Electrical Section, Winnipeg Branch, were favoured December 6 by a paper on the Des Joachims Hydro-Electric Development, which was given by Mr. W. E. Taylor, assistant electrical engineer, Generation Department, Hydro-Electric Power Commission of Ontario.

The members were very honoured indeed to have Mr. Taylor give the paper, particularly since the distance he had to come entailed some time and expense. An expression of thanks was made by the meeting to Mr. Taylor and those members of the Hydro-Electric Power Commission of Ontario who helped make the trip possible.

The Des Joachims Development, even though the first two units were brought into service in July, 1950, is still of considerable interest to Canadian engineers. It is the largest capacity hydro-electric project that has been developed to date on the Ottawa River, being 480,000 hp., supplied by eight units operating at a head of 135 ft.

It is gratifying to see that even in this time of extreme demand for electric power, large developments are possible by a commission of a province on a river which, for the most part, forms the boundary between two provinces. The Ottawa River, throughout the greater part of its length, forms the boundary between the Provinces of Ontario and Quebec.

An interesting side note was pointed out by Mr. Taylor, and that was with regard to the name of the plant, namely Des Joachims. This is a family name of a French Canadian family who settled at or near the site some time ago. There is also, it seems, some discrepancy with regard to the proper pronunciation.

Mr. Taylor used many slides, showing the different stages in the construction. The coloured slides were particularly effective. Many who are more familiar with the local generating plants were very impressed by the attractive control room, and the very effective colour schemes which were used both in the generating room and control room. Even the staircases to the generators had quite a streamlined effect. It was interesting to note, too, that each generator is a totally enclosed unit. Mr. Taylor pointed out some of the advantages gained by the use of the enclosure, namely, reduced maintenance cost for cleaning, reduced noise levels and a cooler power house in the summer.

Possibly another novel feature was the location of the main power transformers and switchgear. The main power transformer banks are recessed in an extension of the deck, which extends over the draft tubes. The sections between the transformer banks house the 13.8 kv. switchgear. The recesses are divided by concrete slabs, and those which house the transformer banks are open to the atmosphere on the tailrace side, whereas the switchgear is not. The transformers themselves are rather novel in that they are the shell type, with "form-fit" type cases. Mr. Taylor pointed out that the top section of the tank fits closely over the core and coil assembly, and is welded to the bottom section. This type of construction tends to reduce the physical dimensions of the unit and its total weight. It makes them possibly a little easier to ship as well. The transformers are single phase, stepping up the 13.8 kv. generator voltage to 230 kv., 60 cycle. Each bank of three transformers handles a pair of generators. The generators are connected to separate low voltage windings of the step-up transformer banks.

Mr. Taylor pointed out some features of the low voltage, 15 kv., metalclad switchgear, such as—

(1) The doors of the circuit breaker, arc chute cells are interlocked with the circuit breakers, and the disconnect switches, so that the breaker must be opened before the disconnects can be opened, and both the circuit breaker and disconnect must be open before the arc chute cell doors can be opened to carry out repairs or inspection.

(2) Each cell is provided with a light, and wire protected glass window in each door, to allow visual inspection of each switch.

It was interesting to learn that automatic synchronizers and automatic facilities for starting and stopping a unit by push button control are provided.

The 230 kv. oil circuit breakers are of the conventional three tank design, pneumatically operated. The control cables used are PVC insulated and sheathed, and are brought out to the high voltage switch yard from the power house in a cable trench. A good deal of attention is given to temperature measurements by installing thermocouples in the armature windings, bearings, cooling water, air, turbine bearings, main power transformers, and a potentiometer type temperature indicator for each generator unit.

Professor Williams of the University of Manitoba very effectively thanked Mr. Taylor for his presence and his paper.

Engineers' Wives Association Newfoundland

On Monday, November 5, the wives of members of the St. John's section of the Newfoundland Branch met at the home of Mrs. B. A. Monkman (wife of the chairman of the Branch) to form a Ladies' Auxiliary of the Branch. Officers elected were as follows: president, Mrs. B. A. Monkman; secretary, Mrs. R. P. Hunt; treasurer, Mrs. Wm. Watson; social convener, Mrs. Keith Provost. After the business meeting tea was served by the hostess.

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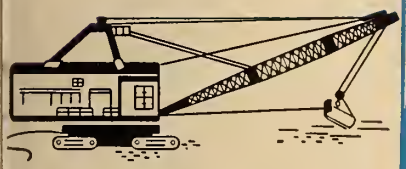

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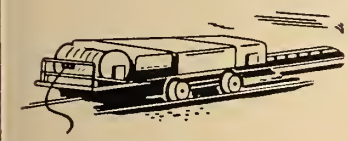

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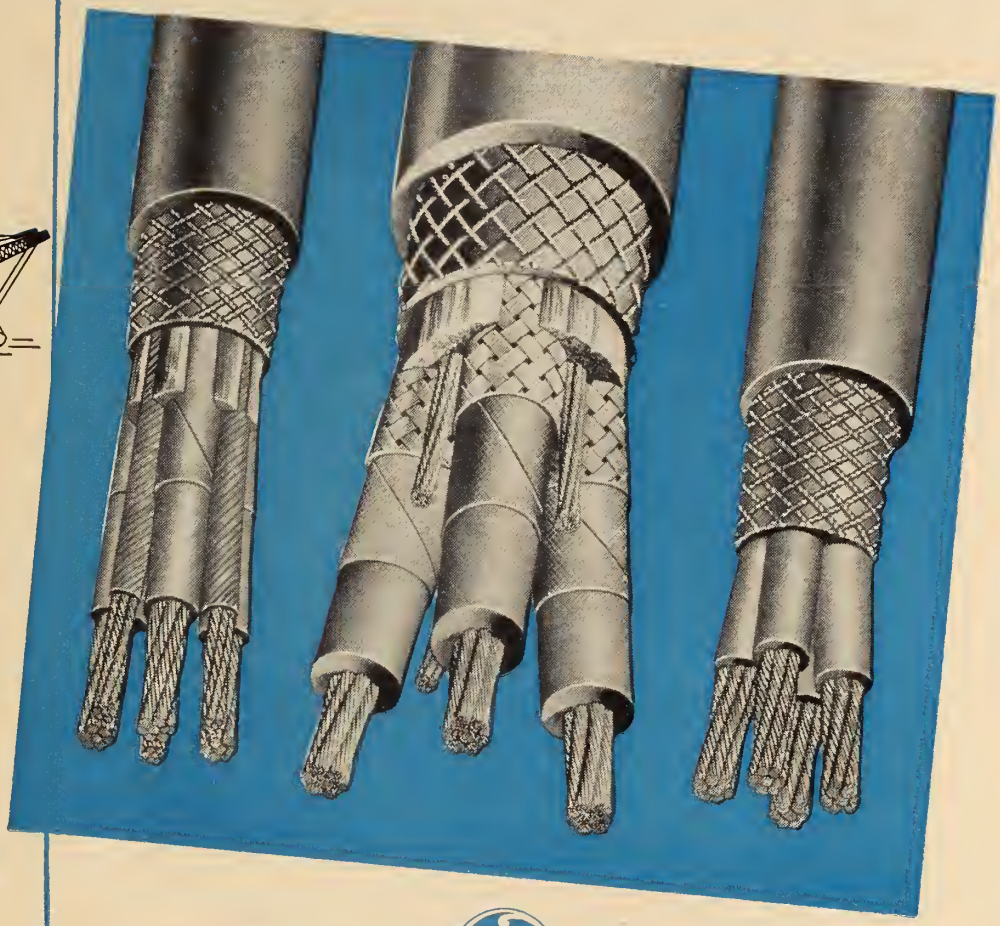

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

The Canadian Oxford Atlas, edited by Clinton Lewis and others. Toronto, Oxford University Press, 1951. 116 pp., illus., $7.50.

Over the past number of years, many people in the book world have seen various atlases appear. But, speaking personally, none had, up until now, struck quite the right note.

But the publication of the OXFORD ATLAS has changed the scene. Perhaps what is so thoroughly pleasing about this atlas is the effect resulting from the fact that as the assistant editor says, "every map has been built up stage by stage from blank paper".

The general style of the atlas is a combination of the old Times Atlas, and of modern Swiss productions; the resulting general effect of colour combinations added to the fact that all the map lettering in the atlas has been done by hand, make for considerable ease of use.

Both the editors, Brigadier Sir Clinton Lewis, O.B.E., and Colonel J. D. Campbell, D.S.O., have worked with the Survey of India over a period of years. Of the assistant editors, Kenneth Cook is largely responsible for the system of colour layering of the maps, and of their clarity and readability. To David P. Bickmore we are indebted for the very detailed gazetteer. The former a lithographer and the latter an honours graduate in geography from Oxford, both these men worked in the geographical section of SHAEF during the past war.

Careful perusal of the pages revealed minor inaccuracies, but a reading of the addenda and corrigenda revealed far more than we spotted in the text! We are left almost in silent admiration of the producers. But not completely. If roadways and county boundary lines are both in red, we would suggest a different colour for country divisions—perhaps purple. This sameness of colour is particularly confusing in the more heavily populated areas.

In addition to the regular maps and gazetteer, maps showing elements of structure, population, precipitation and temperature by months, economic development, predominant land use, etc., are included, and a general key of foreign place name pronunciations. Also the chapter on map projections will be an informative one for a good many people.

Unfortunately, the Oxford Atlas was not published in time for us to draw it to the attention of our readers for Christmas, but it is a necessary addition to all libraries and a much to be desired addition to most households at any time of the year. E.K.

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BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

Astronomy of Stellar Energy and Decay; a general Reader's Outline of Facts and Theories about the Life-history of Stars, and a Student's Introduction to Their Radiation, Steady or Varying or Catastrophic. Martin Johnson. New York, Dover. 216 pp., illus., $3.50.

This book aims at bridging the gap between "popular astronomy" and the research literature of stellar physics. The problems discussed are: What is a star? How much light and heat does it radiate? How much material does it contain in what volume? What sources of energy, gravitational or atomic, replenish that lost energy and for how long? Why do some stars erupt, others pulsate, others apparently explode or collapse? Are there general laws deciding whether stellar evolution is quiet or catastrophic? The book is divided in two parts of equal length. While the first is written for the general reader, the second is called "a student's introduction to analysis of the facts and arguments of the theories".

Code for Dwelling Construction, for Buildings Housing One or Two Families; Minimum Standards to Regulate the Erection and Provide for the Safety of Buildings. Ottawa Associate Committee on the National Building Code, 1950. 77 pp., illus., 25 cents.

This code is issued as an advisory document for the use of municipalities and other organizations which need it for the control of their building operations. It is essentially an abridgment of the National Building Code of 1941, from which no technical changes have been made. A few new sections have been added where no appropriate sections exist in the National Building Code itself, but these do not provide any inconsistencies between the two documents.

Conversion Factors and Tables. O. T. Zimmerman and Irvin Lavine. Dover, New Hampshire, Industrial Research Service, 1944. 262 pp., $3.85.

This book was designed to provide, in one convenient volume, an accurate source of fundamental physical relationships, as well as several thousand useful constants for the conversion of units. It will be useful to the engineer and to the scientific or technical worker who must make conversions from one unit to another and frequently from one system of measurement to another. The authors have made every effort to determine the latest and most accurate relationships.

Electroplating and the Engineer. Alan Whittaker. Manchester, Emmott, c1951. 87 pp., illus., 4s. (Mechanical World Monograph No. 64.)

In all branches of engineering, electrodeposition is establishing itself as a major process, and it is the purpose of this booklet to provide the engineer with an introduction to the subject, in order that he may keep abreast of future development. Chapters are devoted to electroplating (surface treatment and deposition), electrolytic finishing, and electrolytic polishing. Others deal especially with chromium plating and alloy plating.

Fundamentals of Electronics. F. H. Mitchell. Cambridge, Mass., Addison-Wesley, 1951. 243 pp., illus., $5.85 (Canada).

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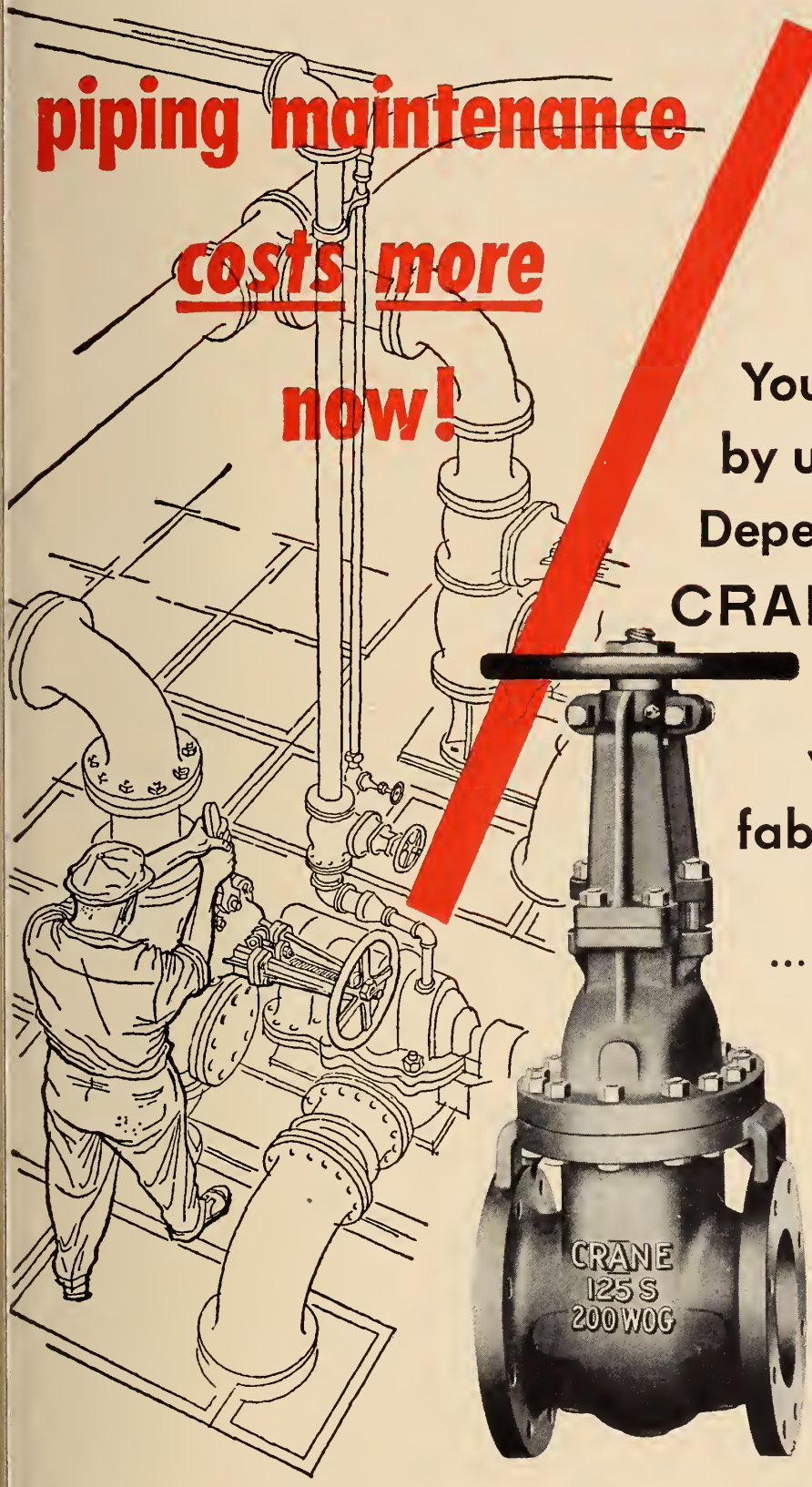

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This is a one-semester course given by professor of physics F. H. Mitchell to students of the University of Alabama. The only training expected from the student-reader is a course in general physics. Two chapters on circuit theory, serving as an introduction to the rest of the book, will be useful to the reader whose familiarity with simple circuits is sketchy. Little calculus is used, although no effort has been made to avoid its use completely; however, the results of the few sections in which it does occur can be assumed without loss of continuity. Throughout this book, emphasis has been placed on instrumentation.

National Scheme for Certificates and Diplomas in Management Studies (Handbook of Courses and Examinations). London, British Institute of Management, 1951. 76 pp., 6/3.

This handbook has been prepared by the British Institute of Management for the guidance of those concerned with the provision of courses in management studies and for the guidance of prospective students. It contains guide syllabuses and detailed conditions for courses provided under the national scheme administered jointly by the British Institute of Management, and other governmental and professional bodies.

Newnes Engineer's Reference Book, 4th ed. F. J. Camm, ed. London, Newnes; Toronto, British Book Service, 1951. 1727 pp., illus., $10.00.

All engineers, as well as toolmakers, foundryworkers, milling, planing, grinding and shaping operatives, electroplaters, welders, and other people dealing with some branch of mechanical engineering, will find this volume invaluable, providing, as it does, a handy, compact and reliable guide and work of reference. This new edition includes tables on the unified screw thread, taper plug-gauge measurement, standard drill jig bushes, tool screw proportions, leather belting, pipe flanges, measures of timber, areas and circumferences of circles, spring formulae, gear tooth proportions, bearing loads, and new sections on collets, feed fingers and pads, rope transmission, anodising, heat engineering, and a large number of other tables too numerous to list here.

Pianos, Pianists and Sonics. G. A. Briggs. Bradford, Yorks, Wharfedale Wireless Works, c1951. 192 pp., illus., 10/6.

Written in non-technical terms, this book is intended for all music lovers and sound enthusiasts. It deals with the piano from every angle: evolution, construction, touch and tone, tuning, toning, etc. The investigation into tone quality constitutes an entirely new approach to the problem. The chapters on harmonic analysis, room acoustics, recording, reproduction and vibration will appeal to all who are interested in radio and records. 102 illustrations are included, 25 of which comprise 75 original oscillograms of sounds and piano tones.

Technology of the Machine Shop. H. C. Town. Toronto, Longmans, Green, c1951. 366 pp., illus., $4.20.

Little information on the scientific aspect of metal-cutting by the machine tool existing at present, this book has been written to meet the requirements of advanced engineering students. It contains diagrams and descriptions which are representative of the latest practice in mechanical, electrical and hydraulic operation of all types of machine tools. Recent developments in cutting tools are introduced with much new information on diamonds, and cemented carbides, as well as comprehensive descriptions of the latest designs of precision finishing tools such as fine boring machines, The comparatively new subject of automatic sizing and measurement during machining is also fully described.

Work Study and Incentives: an Introduction. A. J. Speakman. Manchester, Emmott, 1951. 90 pp., illus., $1.00. (Mechanical World Monograph No. 63).

In writing this book the author has made no attempt to write a textbook on time and motion study, but rather to interpret the current trend of thought on these subjects against the background of everyday industrial problems. He has attempted to cover a fairly wide field, in order to emphasise the need for production planning as the prerequisite of work measurement and application of incentives. The book includes a bibliography and a few diagrams.

World Resources and Industries: a Functional Appraisal of the Availability of Agricultural and Industrial Materials, rev. ed. E. W. Zimmermann. New York, Harper; Toronto, Musson, c1951. 832 pp., illus., $10.00 (Canada).

An attempt is made in this book to render more fully and more readily available, for the student of economics, material which allied social sciences, especially geography—human, social, cultural and economic—have brought to light. To a lesser degree, the fields of natural science and of technology have been drawn upon. The major purpose of this book is not to enlarge the body of scientific knowledge but to render more effective the teaching of the social sciences in general and of economics in particular. Whether he is dealing with agricultural or industrial resources, the author's method always remains comparative: comparison between production of two products, or of the same product in two countries, or of the same product during two periods. This dynamic approach is also evident in the great many tables of statistics, economic maps, diagrams and photographs. There are bibliographical references at the end of each chapter, and a 23-page index at the end of the volume.

To those of our readers familiar with the former edition of this volume, news of its revision will be most welcome information.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Industrial Furnaces, Volume I. W. Trinks. 4th ed. New York, Wiley, 1951. 526 pp., illus., $12.50.

The fourth edition of Volume I of this important treatise has again been thoroughly revised, some forty percent of the book having been entirely rewritten. The work is a comprehensive exposition of the principles which underlie furnace operations and the design of furnaces for heating and annealing metals. The capacity, fuel economy, strength and durability of furnaces and the movement of gases in them are discussed theoretically and practically. Heat-saving appliances are dealt with in detail with particular reference to industrial furnaces.

Theory of Perfectly Plastic Solids. W. Prager and P. G. Hodge, Jr. New York, Wiley; London, Chapman, 1951. 264 pp., illus., $6.90.

An introduction—on the intermediate level—to a particular branch of the general theory of plasticity. Although treating "mathematical" theory, the material has been chosen for its usefulness to the research engineer and the student of engineering. For example, the behavior of trusses, beams, slabs, etc., under various forces is considered as well as certain processes such as metal punching and extrusion.

United States Highway Research Board; Proceedings of the Thirtieth

New Wiley Books on sale at University of Toronto Bookstore

Canada's only bookstore with a complete stock of scientific and technical books

Plastics Molding

By John Delmonte. An application of the basic principles that are the essence of successful molding practice, written in a way most useful to plastics molders. Covers molding equipment and operations primarily. $11.25.

Electrical Measurements

By Forest K. Harris. Helps engineers to meet the challenge for greater precision in electrical measurement. An expert discusses the use of electrical instruments, corrections for precision, and limitations of equipment. Price not set.

D.C. Power Systems for Aircraft

By R. H. Kaufmann and H. J. Finison. Includes performance data obtained under actual flight conditions, operating theory developed with a minimum of mathematics, curves and charts designed for easy reference, and 139 illustrations chosen for the greatest usefulness.

UNIVERSITY OF TORONTO PRESS

Annual Meeting, Washington, D.C., January 9-12, 1951. Edited by R. W. Crum and Associates. 532 pp., illus., $7.50.

The forty-six papers printed in this current volume are divided into the following major subject groups: economics, finance, and administration; design details, covering pavements, bridges, and other structures; materials and construction, including tests; maintenance; traffic and operations; soils and soil mechanics. The volume also contains lists of papers and reports released in other publications of of the Board.

Wavelength Tables for Sensitive Lines. L. H. Ahrens. Cambridge, Mass., Addison-Wesley, 1951. 86 pp., illus., $3.75.

Prepared particularly for the analysis of minerals, rocks, soils, meteorites, and related materials, these tables give identifying spectrum lines for 68 elements, arranged alphabetically. Complete listings of possible interference lines are given for each element, and high and low excitation potentials are given in volts. Auxiliary tables of visual sensitivities, approximate detection-limit concentrations, etc., are also included.

STANDARDS

ASTM Standards, American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.

Textile Materials (with Related Information). 597 pp., illus., $5.00.

This standard covers asbestos, bast and leaf fibres, cotton, glass textiles, rayon and silk, wool, pile fabrics (carpets), felt, as well as general fibers, fabrics, yarns, threads and cordage. It also deals with identification, qualitative and quantitative analysis, and resistance to insect pests and micro-organisms. Methods of testing strength and snag resistance of hosiery are described. The reader will find extensive sections of photomicrographs of common textile fibers and of defects in woven fabrics. Included in this compilation for the first time are well illustrated methods of test for resistance to abrasion of textile fabrics. This standard also contains a glossary of textile terms and of terms relating to hand of fabrics.

British Standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W.1. British Standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 949: 1951—Screwing taps. 15/-.

This new edition includes a number of additional tables of general dimensions and tables of limits of size and tolerance of taps for the recognized British Standard thread series including Unified screw threads. Information is also given which enables limits and tolerances of taps for special threads, and for intermediate nominal sizes not included in the standard, to be readily calculated. Tolerances and limits have been selected with due regard for the production of tapped holes within the limits laid down in the British Standards for the threads themselves.

B.S. 1121, part 22: 1951—Methods for the Analysis of Iron and Steel. Part 22: Tin in Ferro-Tungsten and Tungsten Metal. 1/-.

The method proposed is based on the isolation of tin as the sulphide using molybdenum sulphide as a carrier. Tungsten is retained in solution as a complex with ammonium citrate; the tin is reduced to the bivalent condition with metallic aluminum in the presence of an antimony salt and the reduced tin titrated with standard iodate solution.

B.S. 1724:1951—Bronze Welding. 3/6.

This British Standard covers requirements applicable to bronze welding by any of the following processes: oxy-acetylene, oxy-hydrogen and oxy-propane. These processes are considered as being of the greatest commercial significance. Separate sections are devoted to bronze welding of copper, mild steel, galvanized mild steel and cast iron. Photographs of oxy-acetylene welding flames are included.

B.S. 1758:1951—Fireclay Refractories (Bricks and Shapes) for Use in the Petroleum Industry. 2/-.

This specification covers dimensional requirements and physical properties for the three grades of fireclay refractories, classified according to the duty for which they are suitable. Although prepared specifically for the petroleum industry, it is expected that this data will be found equally useful to many other users of refractory products.

Canadian Standards. Canadian Standards Association, National Research Building, Ottawa.

CSA B103.1:1951—Application of Hydraulic Remote Control to Farm Tractors and Trailing-type Farm Implements. $1.50.

The purpose of the standard is to establish common mounting and clearance dimensions for hydraulic remote control cylinders and trailing-type farm implements. Its main objectives are: to permit use of any trailing-type farm implement adapted for control by an 8-in. stroke hydraulic cylinder, with the 8-in. stroke hydraulic cylinder furnished with any farm tractor; also to permit same adaptability in the case of a 16-in. stroke.

CSA B103.6:1951—Application of V-belt Drives to Agricultural Equipment. $2.00.

This standard applies to agricultural equipment other than farm tractors and is intended primarily to cover drives using V-belts having fibre tensile members. Acceptable manufacturing tolerances, methods of measuring, and proper methods of application are included. Agricultural engineers will be provided with sufficient technical data to enable them to properly apply V-belt drives to agricultural equipment.

CSA B109:1951—Marine Valves and Fittings. $1.25.

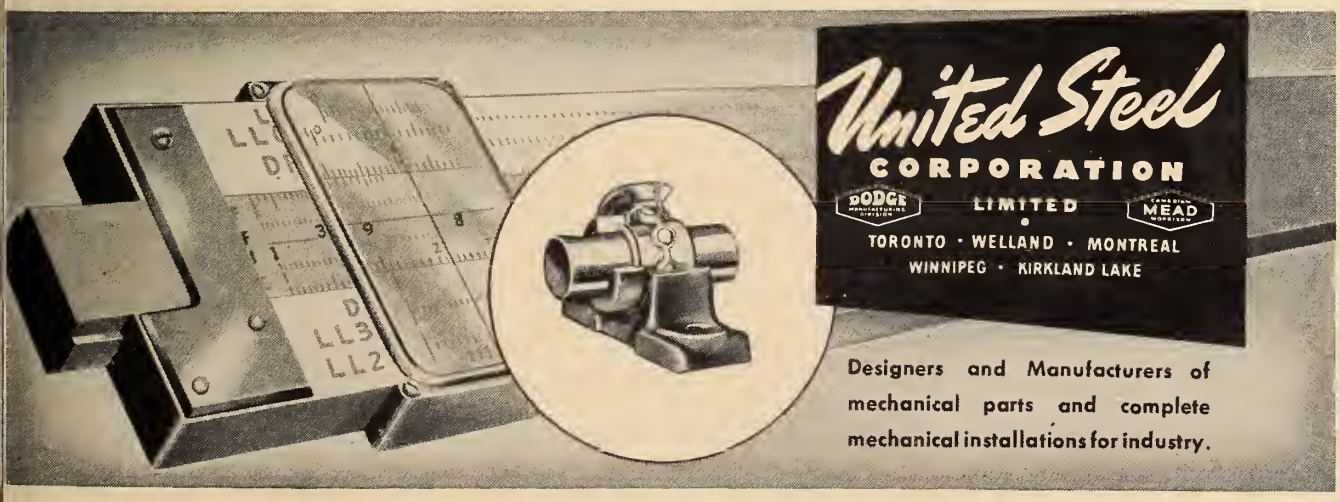
This specification covers a series of valves and fittings for varying conditions of service, in which the assembly dimensions have been standardized for each individual size. The valves and fittings are divided into three types, namely bronze, steel and iron, to meet all service conditions. Suitable chemical and physical properties are given for each type, including carbon and alloy steels used where the butt-welded type of valve is desired.

TECHNICAL BULLETINS RECEIVED

American Society for Testing Materials. Bibliographies: Articles on Fatigue.

Bell Telephone System. Monographs:

No. 1859—The N-1 carrier telephone system, by R. S. Caruthers and others. No. 1860—The potential analogue method of network synthesis, by Sidney Darlington. No. 1861—A 1.5-kw 500-mc grounded grid triode, by C. E. Fay and others. No. 1862—Iron-silicon alloys heat treated in a magnetic field, by Matilda Goertz. No. 1863—Pyrolytic film resistors: carbon and borocarbon, by R. O. Grisdale and others. No. 1864—The mobility of electrons in silver chloride, by J. R. Haynes and W. Shockley. No. 1865—Storing video information, by A. L. Hopper. No. 1866—The origin of bombardment-enhanced thermionic emission, by J. B. Johnson. No. 1867—Seventy-five years of the telephone: an evolution in technology, by



W. H. Martin. No. 1868—Magnetostriction and morphic effects for a nickel crystal, by W. P. Mason. No. 1869—High-temperature low-coefficient quartz crystals, by W. P. Mason. No. 1870—Dielectric properties of sodium and potassium niobates, by B. T. Matthias and J. P. Remeika. No. 1871—Measuring plastics with high frequency sound, by H. J. Meskimin. No. 1872—Dissipation and elasticity of soft plastics, by H. C. Rorden and A. Grieco. No. 1873—The use of silicon and germanium as optical elements, by R. G. Treuting and H. B. Briggs. No. 1874—Duality as a guide in transistor circuit design, R. L. Wallace, Jr. and G. Rainsbeck. No. 1875—Semi-conductor surface phenomena, by W. H. Brattain.

Canada. Department of Resources and Development. Forestry Branch. Bulletin:

No. 98—Red alder in British Columbia, by K. W. Rymer. No. 99—Factors influencing the manufacture of sawlogs into lumber in Eastern Canada, by G. E. Bell. No. 100—Effects of chemical treatment of pulpwood trees, by D. C. McIntosh. No. 101—Sawdust as fuel in Eastern Canada.

Canada. National Research Council. Associate Committee on Soil and Snow Mechanics. Soil Mechanics Bulletin:

No. 2—Annual report of the Canadian section of the International Society of Soil Mechanics and Foundation Engineering, June 1950-June 1951.

United States. Highway Research Board. Bulletin:

No. 40—Load-carrying capacity of roads as affected by frost action. No. 41—Traffic surveys by post card. No. 42—Soil compaction.

BOOKS RECEIVED

ABC of Plain Words. Sir Ernest Gowers. London, H.M.S.O.; Ottawa, United Kingdom Information Office, 1951. 146 pp., 75 cents.

Barrages en terre. Ch. Mallet and J. Pacquant. Paris, Eyrolles, 1951. 345 pp., illus., 2500 fr.

Béton précontraint; étude théorique et expérimentale. Y. Guyon. Paris, Eyrolles, 1951. 702 pp., illus., 4500 fr.

Business Executive's Handbook, 3rd ed. S. M. Brown, ed. New York, Prentice, c1947. 1600 pp., $7.50 U.S.

Coastal Engineering, Proceedings of First Conference, Long Beach, California. J. W. Johnson, ed. Berkeley, Council on Wave Research, 1951. 334 pp., illus., $4.50.

Elementary Text in Hydraulics and Fluid Mechanics. R. W. Powell. Toronto, Macmillan, 1951. 316 pp., illus., $4.95.

Equivalent Circuits of Electric Machinery. Gabriel Kron. New York, Wiley, 1951. 279 pp., illus., $12.50 U.S.

Flood Damage and Flood Control Activities in Asia and the Far East. Bureau of Flood Control, Economic Commission for Asia and the Far East (UN). Toronto, Ryerson, 1950. 82 pp., maps, $1.50.

Helicopter Analysis. A. A. Nikolsky. New York, Wiley, c1951. 340 pp., illus., $7.50.

Instrumentation of Open-hearth Furnaces. British Iron and Steel Research Institution. London, George Allen & Unwin, 1951. 159 pp., illus., 30s.

International Glossary of Technical Terms Used in Housing and Town Planning. H. J. Spinak, ed. The Hague, International Federation for Housing and Town Planning, c1951. 144 pp., $3.50.

Manufacture of Iron and Steel. Vol. 2. Steel Production. G. R. Bashforth. London, Chapman, 1951. 461 pp., illus., 45s.

National Directory of the Canadian Pulp and Paper Industries. J. N. Stephenson, ed. Gardenvale, National Business Publications, 1951. 474 pp., $3.00.

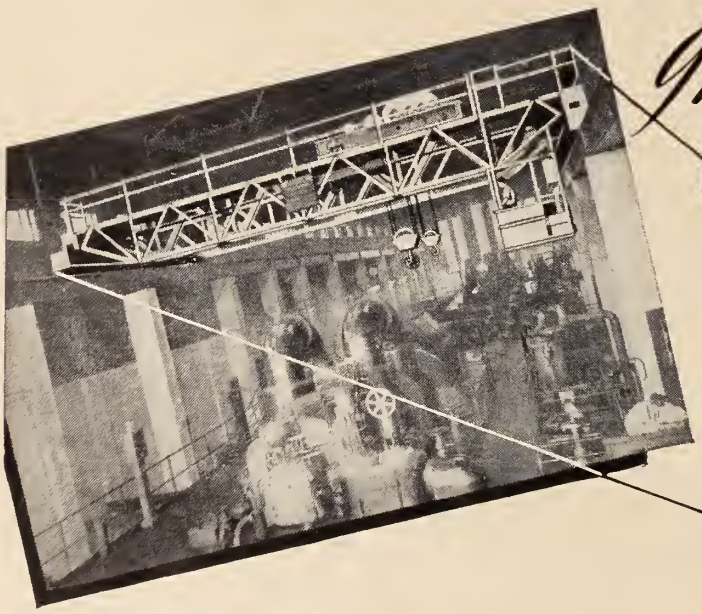
Non-ferrous Metal Committee. Report. Organization for European Economic Co-operation. Toronto, Ryerson, 42 pp., 75 cents.

TV and Electronics as a Career. Ira Kamen and R. H. Dorf. New York, Rider, c1951. 326 pp., illus., $4.95.

Tensor Analysis; Theory and Application. I. S. Sokolnikoff. New York, Wiley, 1951. 335 pp., illus., $7.50.

Water and the Power; Development of the Five Great Rivers of the West. A. N. Williams. New York, Duell, Sloan & Pearce, c1951. 378 pp., illus., $4.50.

Work of Oscar Niemeyer. Stamo Papadaki. New York, Reinhold, c1950. 220 pp., illus., $9.00.



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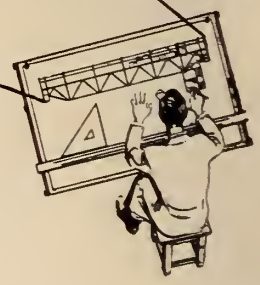

REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL, P. Q. (Walter M. Smith — President). MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. BRITISH COLUMBIA: Vancouver Engineering Works Ltd., 519 to 659 West Sixth Avenue, VANCOUVER, B. C.

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BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

New Equipment and Developments

George Kent Equipment.—George Kent Ltd., hydraulic engineers, Royal Bank Building, Toronto 1, Ontario, have introduced to the Canadian market a new loss differential pressure producing device known as the "Dall Tube". This new tube is, for a given differential pressure, smaller and lighter than the Short Venturi; and in differential-pressure recovery it is claimed to be superior even to the Long Venturi. This has not been accomplished at the expense of accuracy, for the discharge coefficient of the Dall Tube is stable and constant over its whole range.

Made of cast iron or steel, with a liner of brass or gunmetal, the Dall Tube consists of a short length of "lead in" parallel pipe followed by two cones spaced apart at the throat, allowing a small gap. The larger end of both cones is appreciably smaller than the pipe bore. Both the cones are short and for the smaller sizes fully machined. Above about 24-inch pipe diameter only the centre portion of each cone is machined. Upstream pressure is taken out just before the larger end of the approach cone, while the throat tapping is within the chamber formed by the cone walls, in line with the gap between them.

The Dall Tube is much shorter than the Venturi, averaging little more than one and a half pipe diameters long, and is therefore correspondingly lighter and can be made a complete unit. For complete information communicate with the Company at the address given at the beginning of this item.

•

Large Order for English Electric.—English Electric Company Limited, London, S.W.1, England, have announced that they have received an important order for a sixty M.W. steam-turbo alternator for the J. Clark Keith Generating Station at Windsor, Ontario. This new station is being constructed for the Hydro-Electric Power Commission of Ontario. Three similar turbo-alternators for the same station have already been ordered by the Commission from the same firm. This fourth set will bring the station's total capacity to 264,000 kilowatts.

•

New Phenol Plant.—The importance of phenol to Canada's rapidly expanding industrial economy is emphasized by an announcement that the Canadian Kellogg Company Limited, a subsidiary of the M. W. Kellogg Company, refinery and chemical engineering-contracting firm of New York City, has been awarded a multi-million dollar contract for a unique phenol plant at Montreal for the B.A.-Shawinigan Limited, a new Company jointly owned by the British American Oil Company and Shawinigan Chemicals Limited.

According to Kellogg, the new plant, which will produce thirteen million pounds of phenol annually, will be the first commercial unit of its type. It employs a process under license from the Hercules Powder Company of Wilmington, Delaware, and Distiller Limited, London, by which cumene, a petroleum derivative, is oxidized to produce both phenol and acetone. Cumene will be piped from the Montreal refinery of British American Oil Company. Both phenol and acetone, upon completion of the unit, will be available for sale to Canadian industry and for export.

•

Westinghouse Purchase.—The Canadian Westinghouse Supply Company Limited, Hamilton, has purchased the wholesale division of the Nipissing Electric Company, North Bay.

•

Monsanto Expansion.—As a further move in the expansion of its chemical research programme in Canada, Monsanto (Canada) Limited has completed arrangements for the erection of a new research laboratory and pilot plant at its Ville La Salle plant. Construction is scheduled to begin within the next few weeks on the structure which, when completed, will more than double the Company's research facilities. Cost of the building and equipment have been estimated at $400,000.00.

•

First Gas-Turbined Ship.—The world's first gas-turbine powered merchant ship — the 12,000 ton tanker "Auris" — has been put into regular service, Shell Oil Company Limited of Canada announced recently. The "Auris" recently completed successful sea trials on a voyage to the Caribbean.

Considered one of the most important recent developments in the shipping field the tanker's new type engine offers several clear advantages. The gas turbine has only two moving parts, it is many tons lighter than other types of engines and requires considerably less space than ordinary engines of the same power.

•

Welding Courses. — The Canadian Welding Bureau, earlier in the year, announced the availability of approximately one hundred welding courses printed in excess of last year's requirements. As over 1,000 supervisors, engineers and others had previously taken the course it was anticipated that this would reach the current demand. The Bureau now advises that to date over 200 applications have been received and enquiries are still coming in. Accordingly it has become necessary to again reprint and a second course will be made available.

This second course will commence around the middle of January and continue for about a year, with an intervening holiday period during the summer months. The course consists of a total of 17 lessons comprising in all over 375 pages. For complete information communicate with Canadian Welding Bureau, 22 College Street, Toronto, Ont.

•

Street Car Monitoring.—An electric system of monitoring the streetcar system enables one man to know the whereabouts of every streetcar and trolley coach along the six hundred miles of track and road serviced by the Philadelphia Transport Company.

Using the monitoring equipment, a single dispatcher at headquarters can help keep the vehicles on a regular time schedule. Nucleus of the system is a battery of one hundred and thirty remote controlled time switches and a two-way radio control, both developed by General Electric engineers. Complaints about delays in service have been reduced by more than fifty per cent since the system was installed.

Approximately two hundred delays are handled daily through the monitoring network. For further information on this development communicate with Canadian General Electric Company Limited, 212 King Street West, Toronto 1.

•

New Oil Tanker.—The third in a fleet of the largest freshwater tankers in the world was launched at Collingwood, Ontario, on December 6 before many spectators.

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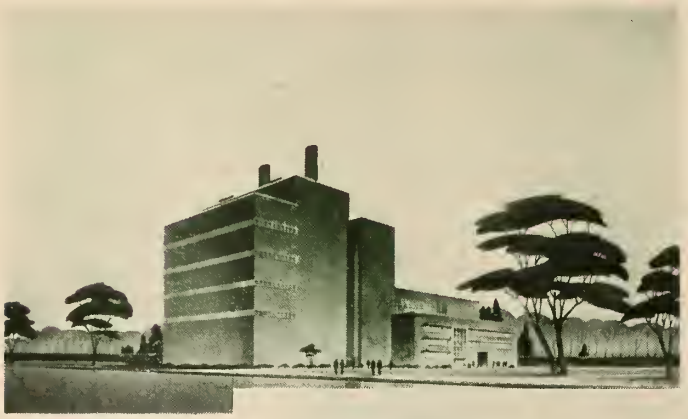
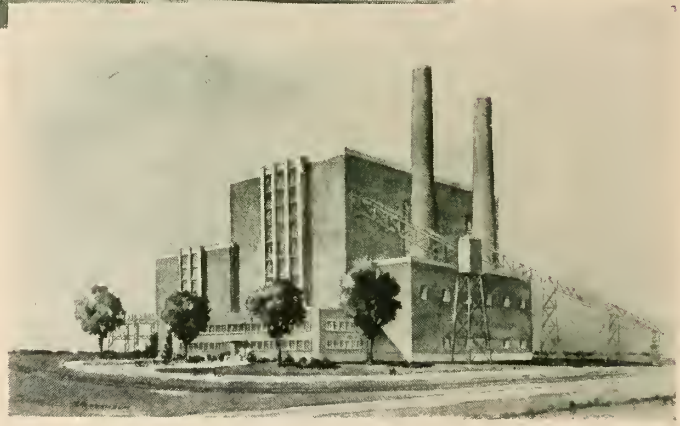


LEFT: The 264,000 kw (four units) J. Clark Keith Generating Station of The Hydro-Electric Power Commission of Ontario at Windsor, Canada. H. G. Acres & Co., Niagara Falls, Ontario, Consulting Engineers.

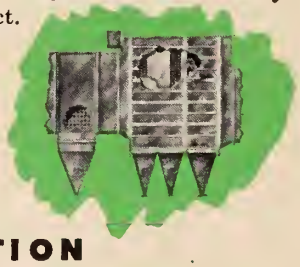


RIGHT: The 400,000 kw (four units) Richard L. Hearn Generating Station of The Hydro-Electric Power Commission of Ontario at Toronto, Canada. Stone & Webster Engineering Corp., Boston, Mass., Engineers and Constructors.

Here's on-the-job proof that Aerotec Series Mechanical-Electrical Dust Collectors are used for continuous efficiency. Guaranteed 97.5%, at normal full load the overall efficiency is anticipated as high as 99% at these two Canadian generating stations of The Hydro-Electric Power Commission of Ontario. Aerotec Series Collectors serving each plant combine a design 3RAS Mechanical and an Electrical Precipitator.

In the Mechanical unit, small diameter, permanent molded aluminum tubes provide high efficiency. Exclusive Aerotec pocket type collecting electrodes in the Electrical Precipitator reduce reentrainment of dust in the gas stream, contributing to a sharp improvement in stack appearance. The combined actions of these units assure maximum dust collection efficiency. Many Aerotec Series installations verify that fact.

Your plant can eliminate dust nuisances with Aerotec equipment just as many well-known companies have done. This highly successful performance is a reliable measure of Aerotec ability to solve your dust collection problems. Write our Project Engineers today!



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THE AEROTEC CORPORATION

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Mrs. Lionel Chevrier, wife of the Federal Minister of Transport, sponsored the vessel. She was named the Imperial Woodbend, after one of Alberta's major oil fields. After outfitting, the new vessel will join her sister ships, the Imperial Leduc and Imperial Redwater, next spring. The vessel will carry crude oil from Superior, Wis., to Ontario refineries. Superior is the terminus of the 1,126-mile interprovincial pipe line from Edmonton to Lake Superior.

•

Plastics Public Relations.—The plastics industry launched its expanded public relations programme at an organization meeting of the public relations committee of the Society of the Plastics Industry, Inc., held recently at the Commodore Hotel, New York. Twenty-four members from companies representing processors of plastic film, sheeting and coated fabrics; moulders; extruders; fabricators; laminators, reinforced plastics processors; raw material manufacturers; machinery and equipment manufacturers; and editorial personnel from industrial publications with an interest in plastics were present.

•

Water Shortage.—A public service programme aimed to make Canadian communities aware of the threat of water shortage and to enlist public support for needed water works projects, was recently introduced by the Canadian General Electric Company before a group of public utility experts.

A feature of the programme is a 25-minute, fullcolour film called "Pipeline to the Clouds", which is to be presented in hundreds of communities as an authoritative and easy-to-understand examination of this important field. The programme also includes a 36-page manual which may be helpful for those sponsoring water works programmes and a leaflet called "The Wonders of Water", suitable for general distribution following the showing of the films. Any organization interested in this programme —civic groups, women's club, chambers of commerce, or other influential bodies —may arrange for its presentation through the nearest office of the Canadian General Electric Company.

•

Concrete Sealer.—Rex Home Supply Company, 142 South Highland Avenue, Ossining, New York, claims to have developed a new glazing sealer for concrete.

Known as "Concrete Glaze", this fast drying clear varnish is especially recommended for concrete floors and other concrete surfaces in plants, warehouses and other buildings. Further information may be obtained by applying to the Company.

•

New Packard Plant Products. — The first shipment from the new plant of Packard Electric Company Limited in St. Catharines, an 85-ton transformer built for B.C. Electric Railway Company, Vancouver, B.C., was made late in November.

In addition to being the first shipment from the new plant, especially designed to accommodate large-scale transformer manufacture, it was the first major shipment from St. Catharines' new industrial

area which borders the Queen Elizabeth Way and the Welland Ship Canal.

The 600-acre tract, formerly farmland, was annexed by the municipality, and is being developed for industrial purposes. The $1,000,000 Packard plant is the largest to be built to date.

The transformer is 15,000 KVA self-cooled and 20,000 KVA forced air-cooled, by fans blowing air through these radiators. It is three-phase 60 cycle, 50° C. temperature rise, and oil insulated. It has three windings each rated at 15,000 KVA, with a high voltage of 60,000 volts Y connected, a low voltage of 4157 volts Y connected, and tertiary of 12,000 volts delta connected. In physical size the transformer is equivalent to a standard-two-winding transformer rated at 22,500 KVA self-cooled.

•

Engine Dynamometer. — An engine dynamometer for testing Diesel and gasoline engines has been installed in the service department of Geo. W. Crothers Limited, Leaside, Ontario, construction equipment suppliers.

•

T.V. For Airport Work. — Televised messages and maps flashed between ground radar operators and traffic control officers at London, England, Airport, are to be tested to help in the task of speeding up of air traffic control. Specially simplified television equipment—the prototype Mulard Electronic Telescribe—is to be used to carry visual messages instantaneously across the airfield from one controller to another.

Control at the London Airport is becoming highly complicated by the growing size of the organization and the increase in traffic, and must be speeded up if jet-powered airliners are to be handled efficiently.

•

New Refrigeration R.R. Cars.—A successful transcontinental road test was recently completed on railway refrigerator cars modified by the Canadian Pacific Railway Company according to a new design developed by the National Research Council. Lower carrying temperatures were obtained for food transport.

Interested readers should communicate with the National Research Council, Ottawa, Ontario, for further information.

•

Huge Coking Plant. — A $24 million coking plant, the most up-to-date and comprehensive in Europe, is to be built at Wingerworth, near Chesterfield, England. It will carbonize more than ¾ million tons of coal a year and produce ½ million tons of coke.

•

Lock Bolts.—The Cherry Rivet Company, a Division of Townsend Company, recently announced the addition of lock bolts to their broad line of blind rivets and structural fasteners. Lock Bolts are high strength, two-piece fasteners, consisting of a pin and a collar. The pin is inserted in the work from one side, and the collar slipped onto the pin from the opposite side. A special pneumatic tool installs the Lock Bolt.

For further information communicate with Hixson & Jorgensen, Inc., 600 St. Paul Avenue, Los Angeles 17, California.

•

New Clock Factory.—One of the world's most modern and spectacular clock factories was opened at Wishaw, Scotland, in October.

Based on the very latest flow methods of production, it has a potential output of 4½ million alarm clocks a year. It is the first time that an entire clock factory in the United Kingdom has been allocated exclusively to the manufacture of this one type.

A substantial proportion of the Wishaw output will go to export. The owners' of the new factory, are at present supplying countries all over the world at the rate of ¾ of a million clocks a year, percentage of alarms in some countries amounted to ninety. Demand is still far in excess of supply. The owners of the new plant are Smith English Clocks Limited, Waterloo Road, Cricklewood, London, N.W.2.

•

New Acme Electric Plant.—Construction progress on the new plant of the Acme Electric Corporation Limited, is rapidly approaching completion and officials of the Company expect that machinery and production facilities will be installed and ready to operate at schedule. The plant, containing approximately 20,000 square feet of floor is located in East York, Toronto.

According to E. A. Miller, president, the transformer lines to be produced will give priority to all types of air-borne, radar, sonar and other military requirements for transformers. In addition, it is expected that oil burner ignition,

CONCRETE RESTORATION

HAVE YOU ANY SUCH PROBLEM?

Gunite can be used effectively on masonry too.
We are ready to submit recommendations.

G&W Ltd. Inc. 1931

GUNITE AND WATERPROOFING LIMITED

Toronto MONTREAL Halifax

WHEN YOUR IH EQUIPMENT
INTERNATIONAL HARVESTER
IS LAID UP WITH ENGINE TROUBLE.....

No matter how serious the trouble.....

IT CAN BE BACK ON THE JOB WITHIN 48 HOURS

Full details on request—

Chas. Cusson Limited
QUEBEC MONTREAL VAL D'OR

fluorescent lighting, and dry type air cooled power transformers will be produced.

•

Gutta Percha Exports.—Gutta Percha & Rubber Limited, expects its 1951 export business to triple that of 1950, according to a statement made by M. O. Simpson, president of the Company.

Mr. Simpson said that Canadian-made Gutta Percha products are now being sold in 26 foreign countries, in addition to the export business handled through the firm's London, England, office.

•

Motor Selection Training.—A new educational programme entitled "Motor Selection and Application" is available from Canadian General Electric Company, to help train personnel in the latest developments in electric motor drives.

The programme consists of nine 35-mm black and white slide films, student review booklets on each lesson and an instructor's manual. Each film has a running time from 15 to 30 minutes and is accompanied by a 16-in. sound recording of the script. The first three slide films are on motor fundamentals, and the remaining six are of a more technical nature.

Prepared to enable any competent engineer to teach the course, the 96-page instructor's manual includes complete instructions on how to plan and set up each lesson, projection information, and complete scripts and pictures for all nine slide films. It also contains questions and answers to accompany review frames attached to each film, references sources and answers to questions contained in the student review book. The material is of a non-commercial nature, and organizations wishing to incorporate it into their own training programme, may purchase the kit from C.G.E. at less than cost. For further information communicate with any office of C.G.E.

•

Liquid Air Regulator.—An automatic regulator for oxygen and acetylene has just been introduced by Canadian Liquid Air Company.

Known as the L. A. PRE-SET, this new type regulator when connected to the gas supply requires no setting. It delivers a constant pre-set pressure automatically until the cylinders are nearly empty.

These new regulators are particularly advantageous when working from a scaffolding or ladders in awkward locations, as welding tips and cutting attachments can be interchanged without having to return to the cylinders to adjust these regulators.

The regulator was designed by Liquid Air engineers and produced in Canada. For complete information communicate with Canadian Liquid Air Company, 1111 Beaver Hall Hill, Montreal, Que.

•

Minnesota Mining Expansion. — Announcement has recently been made by M. H. Patterson, vice-president and general manager of Minnesota Mining & Manufacturing of Canada Limited, London, Ontario, that the erection of their new plant at London is well under way and it is expected it will be in production early in 1952. In the meantime, manufacture of pressure-sensitive tapes, adhesives, coatings and sealers, as well as other products, is being carried on in temporary, leased accommodation in Brantford. A number of new lines including surgical drapes, Offset Litho plates drawsheets and packaging ribbons, have been added since last spring, and it is reported that the business is expanding steadily with a large increase in the sales force having been found necessary in recent months to keep pace with the Company's business expansion.

•

Did you remember to note the ANNUAL MEETING dates?

MAY 7-8-9

at

VANCOUVER, B.C.

They had a problem . . . When World-War-Number-Two laid waste many of the largest Oil Refineries in Europe, it also left the world pitiably short of new or replacement plant. In fact Global disruption was complete. Oil Companies were hard put to know where to turn for supplies of more and yet more refining plant. Their normal sources of supply — although working at fever pitch, were still saturated with orders that would take years to complete. But the need for plant was urgent. The Royal Dutch/Shell Group solved their problem, in part, when they turned to Harveys. For Harveys have one of the most modern and fully equipped works in the world for the fabrication of all kinds of heavy and light plant for the Oil and many other Industries. *In fact Yours the problem – Harveys the answer!*

FABRICATORS **Harvey** IN METAL

G. A. Harvey & Co. (London) Ltd. Woolwich Road, London, S.E.7

NOW faster, cheaper change-overs with BULLDOG BUSTRIBUTION DUCT

PLUG-IN
IN LESS THAN 12 MINUTES

Plugging in and wiring a machine ready for operation at a new location is less than a 12-minute job for an electrician —no down-time for the rest of the line before you cut in power. Only tools needed are a screwdriver and a wrench.

POWER AND LIGHT *where* NEEDED - *when* NEEDED

Tool set-ups can be changed—machines shifted—with no interruption of light or power.

An enclosed electrical system protected against breakdowns and accidental short circuits.

System is engineered for maximum efficient use of scarce materials.

Installation in a fraction of the time required for other distribution systems, with a big saving of engineering time for layout.

Standard, interchangeable sections—100% salvable. Instantly convertible from one production set-up to another.

System can be installed in new plants without waiting for machine layout . . . and machines can go to work as soon as the roof is on.

AEC-BD-51-43

for full details about **BUSTRIBUTION DUCT—**

write to our nearest district sales office

AMALGAMATED
ELECTRIC CORPORATION LIMITED

MONTREAL • TORONTO • WINNIPEG • CALGARY • VANCOUVER

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

New Nickel Company Bulletins.—The following bulletins of recent issue are now available without charge from the International Nickel Company, 25 King Street West, Toronto.

The first "Fabrication and Design of Nickel and High-Nickel Alloy Pipe and Tubing" covers the subject under several headings, including nominal properties and design, bursting pressure, welding, brazing, bending, coiling and cast pipe fittings, available forms of pipe and tubing, tolerances, and specifications. "The Role of Nickel in the Machine Tool Industry" includes sections on the selection of steels and cast irons, with reference to the machine tool industry and the applications of nickel-alloyed materials to machine tool components. "Nickel, Monel, and Inconel—Their Contribution to Chemical Engineering" describes recent developments and current problems in the field, factors in metal selection and the application of the three metals to the problems in chemical engineering. "Investment Casting—Its Advantages and Practical Applications" reviews the entire investment casting field, touching on the advantages, limitations and practical applications of the method. The influence of investment casting on modern design is also discussed. "Practical Solutions for Metal Problems in Pulp and Paper Mills" presents technical data and illustrations to deal with the metal problems and solutions found for them in the pulp and paper industry.

•

Blowers and Exhausters.—A general brochure No. 116-C has recently been issued by Sir George Godfrey and Partners (Canada) Limited, Lachine, Que. This booklet covers industrial blowers, vacuum pumps, gas boosters, and Marshall superchargers. It contains performance tables together with detailed information on blower dimensions, manifolds, filter silencers and pressure relief valves.

•

Canada's Limitless Opportunities.—The October number of the "C-I-L Oval" published by Canadian Industries Limited of Montreal contains articles describing three of Canada's major present day developments. One deals with the plans of the Aluminum Company of Canada for a new power plant and smelter in the Kitimat area of northern British Columbia. Another describes the plans of the Hydro Electric Power Commission of Ontario to greatly enlarge the power output at Niagara. The third article tells of the work leading up to the decision to proceed with development of the northern Quebec-Labrador iron ore deposits and outlines the plans of the Iron Ore Company of Canada for carrying out this major industrial operation.

•

Electric Connector Tool.—A new catalogue has recently been issued by the Buchanan Electrical Products Corporation, Hillside, New Jersey, which illustrates its line of electrical fittings and connectors used in conjunction with the Buchanan Connector tool.

•

Diesel Cooling System Protection.—Announcement is made by the Dearborn Chemical Company Limited of Toronto, Ont., of the publication of a new four-page folder, Bulletin No. 5015, by their parent company the Dearborn Chemical Company of Chicago, Ill.

This folder covers the prevention of corrosion of Diesel and other internal combustion engines in railroad units, ships and stationary power plants, emphasizing the necessity for water treatment, chromate control in closed systems, application of treatment and dosages, as well as test methods in determining concentrations.

•

U.S. Steel Film.—United States Steel Export Company, 360 St. James Street West, Montreal, have available prints of the film "Walls Without Welds". This film illustrates the modern manufacturing methods used in the plants of the National Tube Company, a United States Steel subsidiary.

The film is of 35 minute duration — it is coloured and sound-tracked. To arrange for a showing of the film, communicate with the Company at the address given above.

•

Instrumentation Film.—A new colour film dealing with the absorbing and interesting subject of instrumentation and control in industry is now available for Canadian showings. The title is "Information at Work".

The film deals with the development, manufacture and general application of instrumentation but it also shows how modern control techniques are applied to produce such products as food, films, plastics, petroleum and chemicals. Most dramatic is the portrayal of the intricate steps in the manufacture of a mercury-in-glass thermometer.

The film is keyed to interest any type of audience though it is primarily intended for showings to technical groups. Requests for loan of the film should be made to A. H. Allen, Taylor Instrument Company of Canada Limited, 110, Church Street, Toronto, Ont.

•

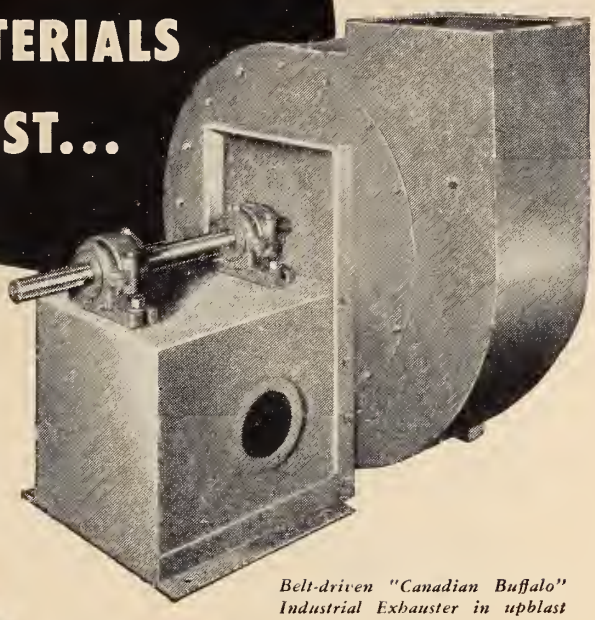
New Pipe Line Strainers. — Several types of pipe line strainers for all purposes ranging in sizes from ½" to 36", some of which embody new concepts of design and function for making continuous production processes possible, are descried and illustrated in a new Pipe Line Strainer Data Manual just made available by J. A. Zurn Manufacturing Co., Erie, Pa. Ask for Manual 951 and apply to J. A. Zurn Mfg. Co., Ltd., P.O. 100, Montreal 28, P.Q.

•

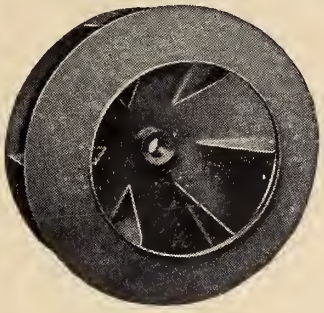
Coal and Ash Handling.—A new 44-page book No. 2410, on coal and ash handling equipment for power plants, has been published by Link-Belt. The book contains helpful layout drawing and interesting photographs of actual

You'll Move MORE AIR MORE MATERIALS at LESS COST...

"Canadian Buffalo" EXHAUSTERS



Belt-driven "Canadian Buffalo" Industrial Exhauster in upblast discharge position.



TYPE "MW" MATERIAL WHEEL

Suitable for materials such as emery dust, saw dust and chips, in fact most anything that can be handled by a pneumatic conveying system.

TYPE "AW" AIR WHEEL

"Canadian Buffalo" Industrial Exhausters are also available with type "AW" Air Wheels, for quiet, thorough removal of airborne dust, fumes, gases, etc.

•

Pumping Problems?

Our associate organization, Canada Pumps Limited, maintains a staff of specially trained representatives to help you solve your pumping problems. Branch offices in principal cities of Canada.

Most plants could improve their efficiency simply by improving their Exhaust systems. The "Canadian Buffalo" Industrial Exhauster shown above, for instance, does a man-size job of removing harmful dust, gases, vapors, grit, grindings, smokes, fogs, mists — making the plant a safer, healthier, more efficient place in which to work. This husky yet light fan moves a big load of air or materials at very little power and maintenance cost. New all-welded housings and rotors give a smooth, rivetless surface . . . cut down resistance . . . give a stronger, lighter, more durable unit.

Write for Bulletin No. 3576. You'll find it very interesting reading.

Canadian Buffalo

CANADIAN BLOWER & FORGE COMPANY LIMITED

HEAD OFFICE: KITCHENER, ONTARIO

ENGINEERING SALES OFFICES: MONTREAL • TORONTO • HAMILTON • SAINT JOHN
PORT ARTHUR • WINNIPEG • REGINA • CALGARY • EDMONTON • VANCOUVER

120,000 personal invitations ensure buying audience

To attract a big audience . . . a buying audience . . . for *your* products at the 1952 Canadian International Trade Fair, 120,000 personal invitations are being mailed to businessmen the world over.

But that's not all . . .

- World-wide advertising, totalling 7,180,257 messages will appear in United States, United Kingdom and Canadian international business publications and newspapers.
- A special World Wide issue of the Financial Post will be circulated to more than 100,000 businessmen in 118 countries.
- Over 100 Canadian Trade Commissioners in 48 countries will support the campaign on the spot to encourage more business visitors than ever before to come to the fair.

For complete details on how *you* can take full advantage of the 1952 Trade Fair, please write to the Administrator, Canadian International Trade Fair, Exhibition Park, Toronto, Ontario.

Expand your business contacts

at the Fifth CANADIAN INTERNATIONAL TRADE FAIR

TORONTO JUNE 2 – JUNE 13, 1952

CANADA'S OUTSTANDING INTERNATIONAL BUSINESS EVENT OF THE YEAR

OPERATED BY THE GOVERNMENT OF CANADA TO PROMOTE YOUR BUSINESS

installations. A copy of the publication will be sent to any *Journal* reader on receipt of request. Address request to Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, Ont.

•

Marine Generating Set. — Davey-Paxman & Co., Ltd., engineers, Colchester, Essex, England, have recently produced a publication describing marine auxiliary generating sets. Ask for publication No. 1272 and communicate directly with the manufacturer.

•

Allis-Chalmers Bulletin. — Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Que., offer a new bulletin which gives complete information covering the Company's line of type SSU unit pumps and type SSB base mounted pumps for handling all non-abrasive liquids.

This bulletin is highly informative and well produced. If copies are required write to the Company and ask for bulletin No. CAC-6039.

•

Metal Paint Covering. — A manual dealing with the scientific protection of structural steel and large metal workings by the efficient use of paint, has been prepared by Canadian Industries Limited for personnel connected with the design, erection and maintenance of steel structures.

Bound in loose leaf form, the illustrated publication includes sections on the cause and prevention of corrosion of iron and steel, factors affecting performance of paint systems, component parts of metal protective paints, general application specifications with charts on recommended painting systems, production specifications and the use of colour in structural steel painting. A special article deals with the proper application of paint on aluminum.

The manual is available on request. Write to Canadian Industries, Paint and Varnish Division, P.O. Box 10, Montreal, Que.

•

Oil and Grease Seals. — Complete information on the Company's Klozure oil and grease seals for bearings is available in a 100-page catalogue just published by the Garlock Packing Company Limited. The catalogue contains illustrations of all types of Klozures, typical applications and a complete list of sizes and part numbers. In addition it describes in detail Garlock's mechanical pressure seals for rotary shafts. Copies are obtainable from the company on request. Ask for catalogue No. 10. Address requests to Garlock Packing Co. of Canada Ltd., 620 Cathcart St., Montreal, Que.

•

Furnacing Ammunition. — Surface Combustion Corporation, Toledo, Ohio, have introduced a new bulletin to facilitate selection of furnace equipment for the manufacture of large calibre ammunition. Sections of the bulletin are devoted to the production of high explosive projectiles, armour piercing projectiles, steel cases and brass cases. Ask for bulletin No. SC-154. Address requests to the Company at Toledo.

•

(*Continued on page 86*)

Cansfield TRANSFORMERS

unequalled for efficient, trouble-free service!

Cansfield Dry Type
Indoor Transformers

Cansfield Oil Cooled
Distribution Type
Transformer

Cansfield Transformers are available in oil cooled, air cooled or furnace types, and special types can be designed for particular applications. Consult Cansfield engineers on your requirements.

Choose *Cansfield*
for Transformers, Relays, Thermostats

CEW

ufactured by CANSFIELD ELECTRICAL WORKS Limited
TORONTO, CANADA

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 82*)

Nickel Alloy Bearing Metals.—Reprints of the 3rd, 4th, 5th and 6th in a series of seven papers prepared by the International Nickel Company, 25 King Street West, Toronto, are now available. The titles of these papers are respectively, "Bearing Metals—Nickel-Alloyed Brass and Bronze", "Properties and Applications of Copper-Base Alloys", "The Nickel-Tin Bronze Theory", and "Nickel-Alloyed Manganese Bronze".

•

Heat Treating.—A new illustrated bulletin on industrial applications of gas chemistry for heat treating has just been released by Surface Combustion Corporation, Toledo, Ohio.

Exothermic and endothermic type atmosphere generators are described and the gas generation processes schematically diagrammed. Compositions of each gas atmosphere and the respective heat treat process applications are described. Write to Surface Combustion Corporation, Toledo 1, Ohio. Ask for bulletin SC-155.

•

New Jas. Robertson Catalogue. — The James Robertson Company (Limited), Montreal 3, Que., have announced the production of a completely revised and up-to-date catalogue which is now available for distribution. The catalogue covers the complete line of plumbing, heating and mill supplies handled by the Company. All items are illustrated and complete specification and informative data is given.

The Company will be pleased to send copies to readers of *The Journal* who, in their business, could make use of the catalogue. Applications should be made on your company letterhead and the request should specify catalogue No. 51.

•

Continuous Grinding. — "Continuous Grinding" a new 28-page catalogue in which Patterson Ball, Tube and Rod Mills are detailed, has been published by the Patterson Foundry & Machine Company (Canada) Limited. Available with a variety of grinding media, these mills operate on the continuous principle, in which the material to be ground is fed continuously through a hollow trunnion at the feed end and discharged continuously at the discharge end.

Included in the catalogue are over 50 illustrations, technical descriptions; and charts which show size, weight, linings, ball charge, speed, power requirements and motor sizes for the various mills. Ask for catalogue No. 514. Write to the Company.

•

Atlas Steel News. — Atlas Steel News is the name of a periodical published by Atlas Steels Ltd., Welland, Ontario. It is a semi-technical publication of good appearance and the style of writing is pleasant. To be placed on the mailing list communicate with the Company at Welland.

•

Conveyor Catalogue. — The Rapids-Standard Co., Inc., Grand Rapids 2, Mich., offer catalogue No. G3-52 in which are described the Company's material flow conveyors. The publication is well produced and profusely illustrated. To obtain copies address requests to the Rapids-Standard Inc., 142 Rapistan Building, Grand Rapids 2, Mich.

•

New Air Reduction Catalogue.—A new catalogue on Aircomatic equipment and wires has been announced by Air Reduction Canada Limited, 180 Duke Street, Toronto.

This catalogue describes the Aircomatic gun for manual operation, the Aircomatic head for automatic operation and the Aircomatic wires for use with either manual or automatic equipment. For copies communicate with the company and ask for catalogue ADC 717.

•

"Powerfax" Magazine. — Elliott Company, Jennette, Penn., are publishers of a highly interesting magazine known as "Powerfax".

This periodical describes the Company's equipment and recent installations. It is of a semi-technical nature and very pleasing in appearance. The Canadian representatives of the Company are F. S. B. Heward & Co. Ltd., New Birks Bldg., Montreal, Que., to whom requests for copies should be addressed.

•

Trane Periodical. — Trane Company Limited, Mowat Avenue at King Street W., Toronto, publish a periodical named "Weather Magic". The publication is devoted to semi-technical description of the products manufactured by the Company and typical installations are shown. To be placed on the mailing list for this periodical please communicate with the manufacturer.

•

Wharton Crane Publications. — The Wharton Crane and Hoist Co. Ltd., Reddish, Stockport, England, offer *Journal* readers the following publications—"The Minimax — a high-lift, high-efficiency pulley block." Catalogue W-121 titled "Wharton Service to Industry." Also, bulletins describing primax overhead electrical travelling crane, electric rope hoist, electric travelling pulley block and catalogue No. W-101 in which is described the Wharton overhead electric travelling crane.

These publications are particularly well produced and would be valuable additions to an engineer's library of equipment data.

Copies will be mailed to applicants on receipt of request on official letterhead.

•

Instrument Sheet. — Minneapolis-Honeywell Regulator Co. Ltd. Leaside, Toronto 17, Ontario, offer a new four-page specification sheet in which are described Brown indicating and recording thermometers. Construction and engineering details are included. Ask for sheet No. 600.

•

Engineer Evaluation.—Recent issues of the Dominion Engineer, published by Dominion Engineering Co. Ltd., P.O. Box 220, Montreal, have been devoted to a series of articles "Evaluating Engineers", by Randolph W. Chaffee, consulting engineer, Kenneth A. McIntyre Associates, Cleveland, Ohio.

The subject matter consists of a discussion of methods for job evaluation and merit rating in creative engineering. For copies of the "Dominion Engineer" containing these articles, communicate directly with the Editor at the address given above.

•

Sulfur Fires.—Because sulfur fires now constitute a special hazard as a result of the increased use of that chemical, the engineering department, fire extinguisher division of Ansul Chemical Company, Marinette, Wis., has prepared a revised technical bulletin covering extinguishment of sulfur fires.

The bulletin points out that the fire hazard has been increased by new methods of processing raw sulfur which emphasize smaller sized sulfur particles. For copies communicate with Ansul Chemical Company, Marinette, Wis., and ask for the bulletin on Sulfur Fire Extinguishment.

•

Power Shovel Development.—Volume 18, No. 9 of the Dominion Engineer is devoted to an excellent article describing the development of the Power Shovel. For copies write to Dominion Engineering Company Limited, P.O. Box 220, Montreal, Que.

•

Appointments and Transfers

Avro Changes. — Avro Canada Limited has announced the following appointments and changes: Edgar H. Atkin, formerly chief engineer, is now holding the newly-created position of technical director. James C. Floyd, formerly works manager, has been named chief engineer and Dennis E. Wiseman, formerly production planning manager, is works manager. Fred T, Smye, a director of the Company, has been selected to give his full attention to the vital production and development of Avro Canada's aircraft in the newly-created position of general manager of the division.

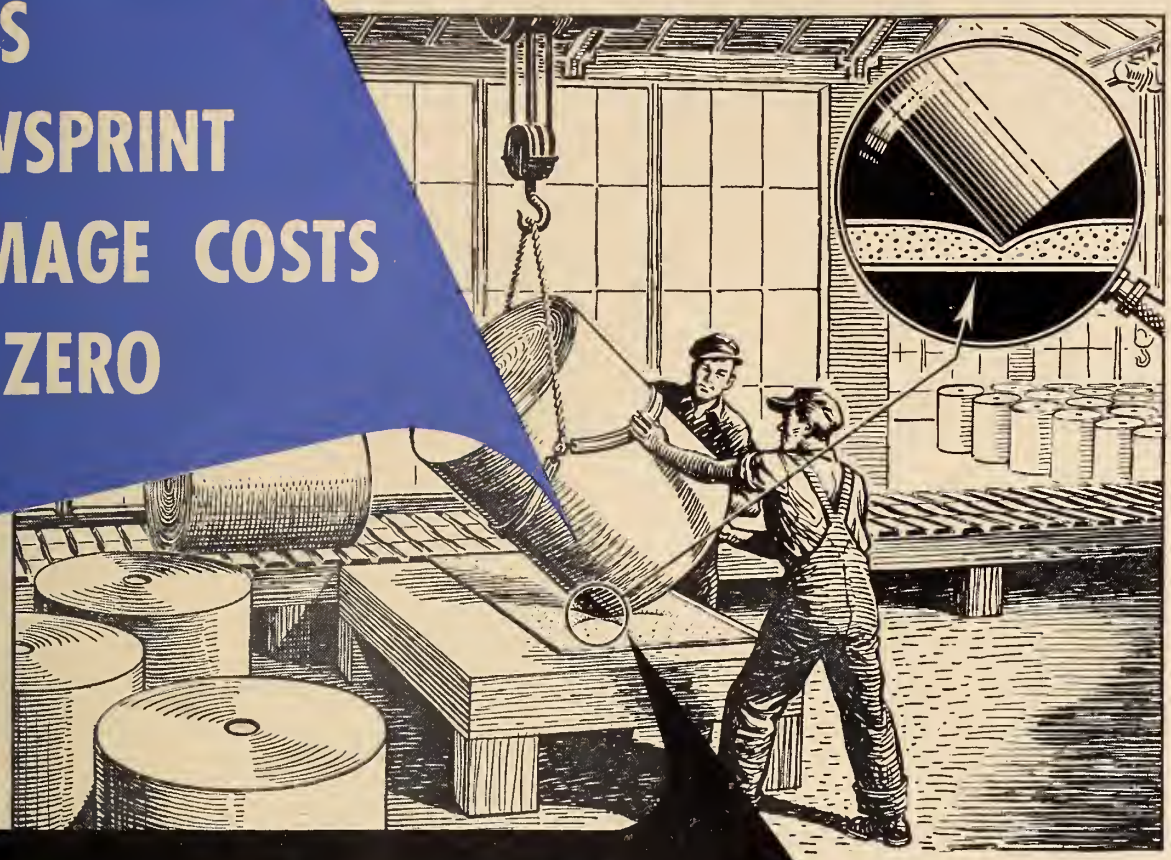
•

Rolls-Royce Appointments. — Dr. Eric Warlow-Davies has been named general manager and chief engineer, and David Boyd, O.B.E., has been appointed production manager of Rolls-Royce, Montreal, Limited. Both men are well-known in Canadian aviation circles. Dr. Warlow-Davies has been in Canada since 1946 in charge of the Canadian interests of the Company, and Mr. Boyd has been identified with several large Canadian industries. From 1945 until quite recently he was works manager of the John Inglis Company Limited, Toronto.

James H. Tivey, until recently general manager of Rolls-Royce Canadian operations, is remaining in Canada for a further period to serve as deputy general manager in charge of existing spares and field service organization, but current plans are that he will return to the United Kingdom to take up a senior engineering appointment.

•

CUTS NEWSPRINT DAMAGE COSTS TO ZERO



GOODYEAR'S VERSATILE "LANDING MAT"

Can take the Jolt

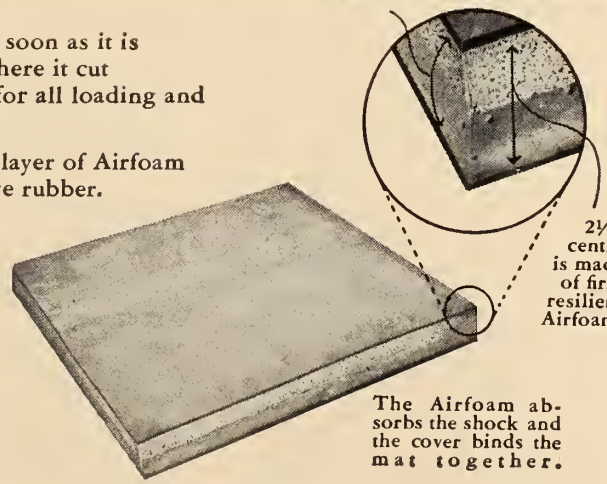
OUT OF YOUR HANDLING PROBLEMS

Section view shows ¼" COVER of high quality live rubber on top and bottom.

A Goodyear Landing Mat starts paying for itself as soon as it is installed. Originated for the newsprint industry, where it cut destructive handling losses to zero, it is also ideal for all loading and unloading operations requiring careful handling.

Goodyear Landing Mats are made of a 2½" centre layer of Airfoam covered top and bottom by a ¼" of high quality live rubber. Available in a variety of sizes, it can be ordered for special applications to fit specific tasks. The minimum size per order is 11 square feet per mat.

If you have any unusual handling problems let Goodyear help you solve them. Write or call your nearest Goodyear Branch—Saint John, N.B., Quebec City, Montreal, Toronto, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver.



GOODYEAR

MG-5168

INDUSTRIAL RUBBER PRODUCTS ENGINEERED FOR THE JOB

W. L. Rambo.—W. L. Rambo has been appointed chemical buyer for the Shell Oil Company of Canada. Mr. Rambo has his office in the headquarters of the Company at Toronto.

•

C. E. Gibbons. — Burndy Canada Limited has announced the appointment of Christopher E. Gibbons as sales representative. Before coming to Canada, four years ago, he was attached to the sales staff of the Lancashire Dynamo & Crypto Company, and after his arrival here he was employed as a sales representative by the Reliance Electric Company.

•

Foster Wheeler Expansion.—The establishment of a new division by Foster Wheeler Limited to serve Canada's expanding petroleum and chemical industries has been announced by George Macnoe, president and general manager. Mr. Macnoe stated that B. L. Denker, formerly of Foster Wheeler Corporation, has been appointed manager of the newly-formed process plants division.

Mr. Denker will direct company activities related to the design, procurement and construction of process plants for the petroleum, chemical, and associated industries in Canada and in the export field served by the St. Catharines industry which has operated in Canada for the past 25 years.

•

Canadian Ingersoll-Rand Changes. — Canadian Ingersoll-Rand Company Limited made the following appointments effective December 1, 1951: John N. Robertson, previously district manager at Kirkland Lake, is now assistant sales manager. He will work from the headquarters of the Company at Montreal. N. E. May has been appointed assistant sales manager (administration). He, too, will be located in Montreal. T. M. Parr, previously manager at Toronto, is now regional manager, with responsibility for Toronto, Kirkland Lake and Timmins Branches. C. J. Timleck, previously manager at Winnipeg, is now manager of the Toronto branch, and D. J. Falconer of Toronto, is now manager at Kirkland Lake. Cameron Macdonald, formerly manager at Timmins, is now manager at Winnipeg, and John Knox is manager at Timmins. (For further information on C. J. Timleck, M.E.I.C., see "Personals").

•

Jas. Robertson Appointments.—Gerald H. Tessier has been appointed manager of the Montreal office of the James Robertson Company Limited. Robert J. McCauley, has been named sales manager for the Montreal district.

Mr. Tessier has been with the Company for the past 25 years. Mr. McCauley has 34 years of service with the Company, the last 23 of which have been in the sales division.

•

T. M. Parr

L. G. Lumbers

L. G. Lumbers.—J. Y. Murdoch, president of Canada Wire and Cable Company, Limited, Leaside, has announced the appointments of O. W. Titus, M.E.I.C. and L. G. Lumbers as vice-presidents of the Company.

Mr. Lumbers as vice-president will co-ordinate the sales, product control and engineering phases of the Company's operations. (For information on Mr. Titus see "Personals".)

•

J. H. Magee. — J. H. Magee has been appointed general refinery manager of the Redpath refinery, Montreal, of the Dominion Sugar Company Limited.

•

Donald MacDonald.—On December 7th, the Honourable Milton F. Gregg, Minister of Labor, announced the appointment of Donald MacDonald, secretary-treasurer of the Canadian Congress of Labor, to membership in the national advisory council on manpower.

•

J. N. Robertson

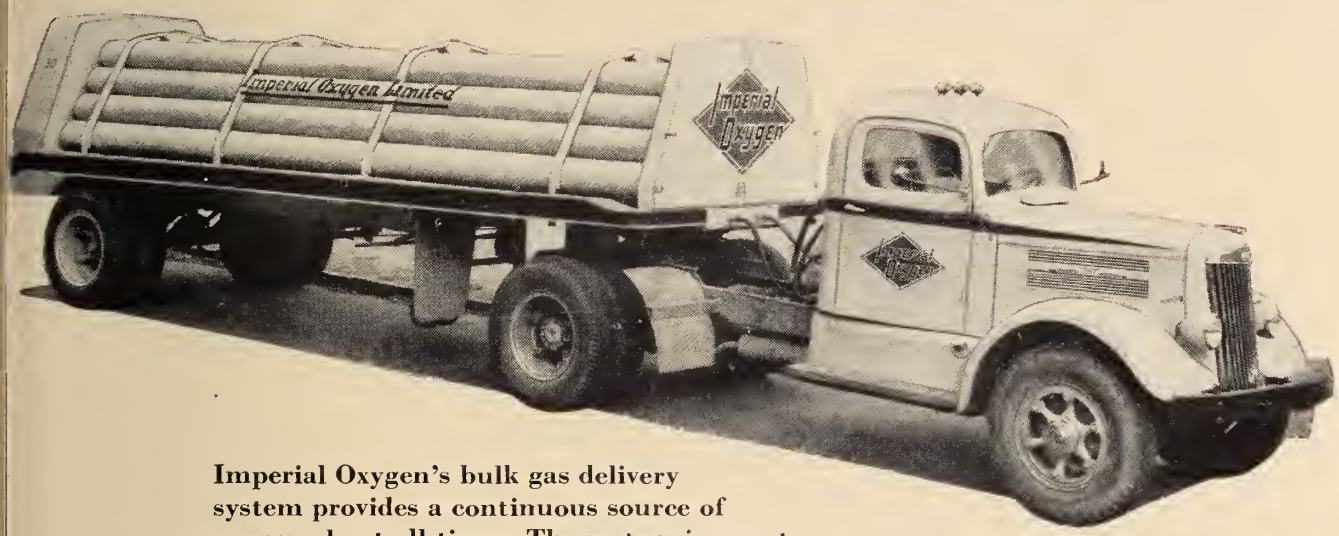
C. Macdonald

D. J. Falconer

arge consumers of oxygen find it pays to use

IMPERIAL'S "BULK DELIVERY" SYSTEM

10,600 Cu.Ft. capacity tube trailer. Smaller trailers are available to consumers requiring a lesser supply of oxygen.



Imperial Oxygen's bulk gas delivery system provides a continuous source of gas supply at all times. The system is easy to install, easy to operate, economical to maintain, and offers many advantages to the Company whose monthly oxygen consumption is high.

- **Automatic:** *The bulk delivery system operates automatically and does not require the attention of the user's personnel.*
- **Eliminates Cylinder Handling and Storage:** *There are no cylinders to handle . . . or store.*
- **Time and Labor Saver:** *Because a constant supply of gas is available, the user profits by not having time lost due to removing regulators from empty cylinders and reconnecting to full cylinders.*
- **How It Operates:** *The tube trailer is parked on the customer's property and connected to the user's low pressure receiving system.*

FOR COMPLETE DETAILS WRITE OR PHONE
THE IMPERIAL OFFICE NEAREST YOU

FOR ALL YOUR WELDING NEEDS

Imperial Oxygen

IMPERIAL OXYGEN LIMITED

Head Office: 8400 Decarie Blvd., Montreal, Que.

Branches: 565 Trethewey Drive, Toronto, Ont. · 3445 Riverside Drive, Windsor, Ont.

Hugh L. McCulloch

R. M. Robertson

B. W. & G. McC. Limited Changes.—At a recent meeting of the Board of Directors of Babcock, Wilcox & Goldie McCulloch Limited, the following executive changes were made: Hugh L. McCulloch resigned the position of president and was elected chairman of the board. He was succeeded in the presidency by W. A. Osbourne, formerly vice-president. R. M. Robertson was elected to the office of vice-president. He is also a director of the Company (see "Personals"). J. G. Goldie was elected a member of the Board of Directors to fill the vacancy created by the death of his father, A. R. Goldie.

•

U. B. & J. Appointment. — Upton Bradeen & James, Toronto, have been appointed exclusive agents for Fried Strip Handling Equipment. Best known of the Fried lines are "the Fried Stripveyor", a highly efficient strip-handling device, the Fried Strip-Stacker, a companion piece to the Stripveyor, and the Fried Liftveyor. For descriptive literature communicate with Upton Bradeen & James, 990 Bay St., Toronto, Ont.

•

National Steel Car Promotions. — National Steel Car Corporation Limited have announced the following appointments: A. Van Hassel has been elected President. O. H. Anderson, who has been associated with National Steel Car for 31 years, and who has served as chief mechanical engineer since 1925 and as a vice-president since 1942, has been elected a director and appointed to the position of managing director. A. P. Shearwood, M.E.I.C., who has been with the Company since 1932, has been appointed vice-president in charge of sales, and H. J. Lang, who joined the Company in 1945, as assistant to the president, is now a vice-president. (For further information on Mr. Shearwood see "Personals", June, 1951.)

•

C.G.E. Appointments.—C. E. Hipp has been appointed vice-president, accounting and finance, and C. A. Morrison, vice-president in charge of public relations. The establishment of a lamp division of the company, as part of a broad-scale realignment of the Company's operating functions, has led to the appointment of E. H. Lindsay as general manager of that division. Vice-president K. J. Corkery has been placed in charge of the Company planning and services.

•

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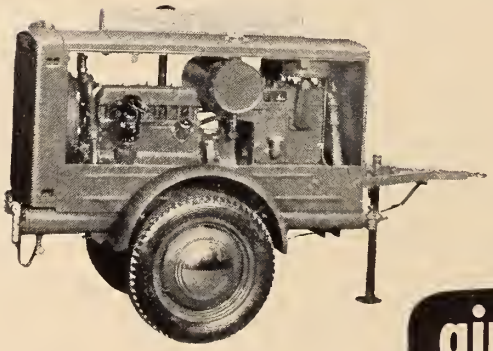

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Fig. 1. No. 1B Colliery.

Coal Mining in Cape Breton

by

Louis Frost, M.E.I.C.

Chief Mining Engineer,
Dominion Steel & Coal Corporation, Limited, Sydney, N.S.

A paper presented before the Halifax Branch of The Engineering Institute of Canada, May, 1951

Outlining the scope and importance of Cape Breton coal operations to the Province of Nova Scotia, the author traces the successive improvements in methods from the simple room and pillar system used in the early days, through the various stages of mechanization, to today's longwall operations using Joy Loaders, "Continuous Miners", electrical hoists, diesel locomotives, and soon a central washing plant. With completion of transportation centralization by slope tunnels and conveyor belts, the Dominion Steel and Coal Corporation will have the longest and most modern colliery unit in Canada.

Coal mining, dating from the year 1720, is now carried on in two localities on Cape Breton Island. One operation is at Inverness on the West Side and the other is in the Sydney area on the East Side of the Island.

The latter, covering a frontage of some 30 miles on the shores of the Atlantic Ocean, is by far the most important area in the Province of Nova Scotia. It produces, from the Collieries of the Dominion Steel & Coal Corporation through its subsidiaries, the Dominion Coal Company Ltd. and the Old Sydney Collieries, 4½ million tons of coal annually, as well as 300,000 tons from independent operators.

The Dominion Steel & Coal Corporation, with the annual output indicated, produces from its collieries in Cape Breton alone, 75 per cent of the total coal produced in the province. Since the formation of its subsidiary the Dominion Coal Company in 1893, and from the Old Sydney Collieries, it has produced a total of 237¼ million tons of coal, adding materially to the industrial and economic welfare of Nova Scotia.

The Corporation, with eleven collieries in its Cape Breton operation, is also the largest employer of labour on the eastern seaboard. The payroll for its coal mining operations alone amounts to 21.2 per cent of the total provincial payroll, on which compensation is paid. Of this amount, 17 per cent is paid by its Cape Breton operations.

The published figures for the year 1949 indicate that the total

provincial payroll amounted to over $144 millions while the wage disbursement made by the Cape Breton Collieries to their employees amounted to $24.3 millions. With the increased wage rates paid in 1950, this figure has been proportionately increased.

Coal Important to Nova Scotia

In order to indicate clearly the importance of these operations to the economy of the province, it is well to note that in direct royalty payments the Cape Breton Collieries since 1893 have contributed some $30 millions to the provincial treasury. Coal production in Cape Breton has been mainly responsible for the industrial, agricultural and business growth of the island, and has in no small measure contributed to the livelihood of every community within the Province. It has also by reason of the relatively high rate of wages paid, materially increased the standard of living, not only in the colliery areas but in the whole of Nova Scotia.

In the long period since the French first mined coal at Louisburg in 1720, the coal mining industry has been beset by many problems both physical and economic. These have been met with courage, determination and engineering foresight by the early planners of the industry, with the result that there remains today an outstanding asset to the economy of the province in a highly organized and planned coal field, which in its operations is equal to any on the American continent.

In the momentous strides made in the development of the largest industrial unit in Eastern Canada, labour has had its full and rightful share, and concurrently employer-employee relationship has reached the highest co-operative standard in the history of coal mining in this province. The recent broad advancement in technical and co-operative developments within the industry will surely result in economies and benefits to be shared equally between those engaged in the industry and the general public.

Early Methods Wasteful

In the early days of the industry in Cape Breton, mining was relatively simple, and the earliest independent operators worked only such seams as were easily accessible and gave the best economic return. Had such methods continued unchecked, the valuable resources of the province in this coal field would have been irretrievably lost. It is due entirely to the unified policy of the General Mining Association, and later the Dominion Coal Company, in consolidating the mining leases, that an orderly development of the field has resulted. While in the early days only the restrictive portion of the seams under land or close to the shoreline were mined, the present development has reached out many miles under the Atlantic Ocean.

In the Sydney area there are a number of good quality coal seams. Those which have been most extensively developed in both the land and underseas area are the Phalen, Harbour and Emery Seams. The land area of the coal seams is limited in extent, and has been mostly depleted except for some small sections which still remain unworked. At this writing the only remaining land areas in operation are in the Gardiner Seam at Reserve Mines, and the Lloyds Cove Seam at Sydney Mines.

The seams dip seaward from outcroppings on the shore. The seaward pitch varies from 7 per cent in the limbs to 50 per cent on the axis of an anticlinal fold crossing the field (Fig. 2). In addition, the sea bottom also dips at approximately 2 per cent.

Consequently, due to the shallow depth of cover overlying the workings and their proximity to the shore line, in the early days—mining was carried on under the room and pillar principle, with the pillars left intact under the ocean.

Under these circumstances it was fairly easy to maintain a relatively large production with only a limited development in mechanical mining and transportation. But as the workings progressed seaward, the problems of ventilation and transport were accentuated. It became necessary to speed up and modernize the various services by mechanizing them wherever possible.

The initial process of mechanization was the introduction, in 1895,

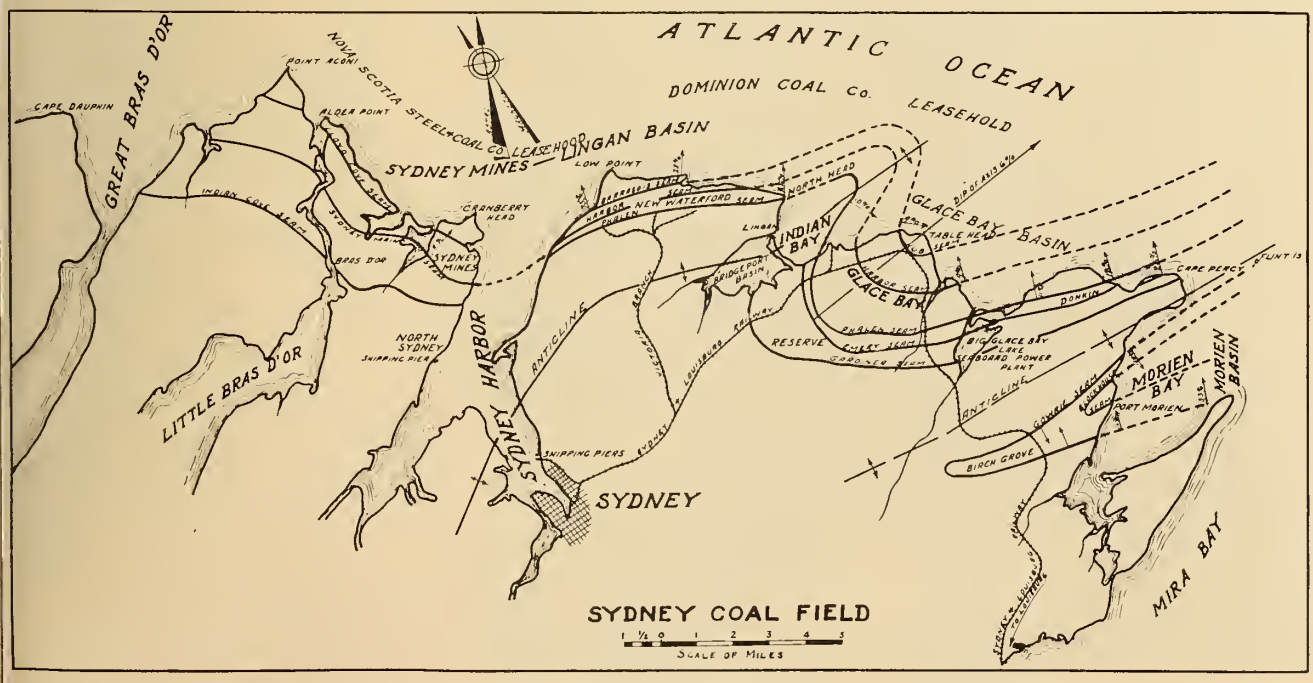

Fig. 2. Sydney Coal Field.

Fig. 3. Electric Trolley Locomotives.

of coal cutting machinery of a percussive type, and the introduction of relatively large electrically and air operated transportation and ventilation units. As far back as 1900 and 1905 compressed air and electric battery driven locomotives were operated to some limited extent.

Costly Roads and Ventilation

With the seaward advance of the workings, the increasing depth of overlying measures also necessitated drastic changes in construction of the type of roadway used in the early days. The shoreline was the last possible point of entry into the seams, and workings were in many cases over three miles from the shore. It became necessary to provide large and costly roadways for the maintenance of an adequate volume of ventilation and transport.

Many of these roadways extend from 2½ to 3½ miles seaward from the point of entry into the seam. They must be duplicated several times to provide adequate area for ventilation purposes alone. With the increasing depths of overlying measures, they must assume a degree of permanency unnecessary in more favored coal mining areas.

To provide for the continuance of operation in the field, it has been necessary to line these roadways with steel or concrete or both, at a cost sometimes in excess of $250,000 per mile. To maintain the present-day output it has been necessary to provide 266 miles of roadways at an overall average cost of $100,000 per mile, exclusive of regular upkeep.

In the early days it was considered sufficient to provide for roadways and ventilating units with an ultimate capacity of 100,000 cubic feet per minute. In many of our present developments provision is made for an ultimate capacity of 300,000 and 400,000 cu. ft. of air per minute.

In the field of transportation a high standard has been developed to suit the varied conditions in the field. In many cases composite systems of haulage are used to transport the coal from the working faces, sometimes over six miles from the mine entry. Electric trolley locomotives and large capacity hoists developing 1800 horsepower are employed with hoisting speeds of 30 to 40 feet per second. In most cases it is necessary to relay the coal four times before it reaches the surface (Fig. 3).

Partial Recovery

In a normal land area the operation of a room and pillar system permits the recovery of some 85 to 90 per cent of the coal seam, depending on the importance of the overlying areas. This percentage of recovery can be made at relatively shallow depths of cover. With an undersea operation like that existing in Cape Breton, however, only partial recovery of the seams is possible. Up to 60 per cent of the coal seam must be left intact, to support the ocean floor until sufficient depth of cover is reached to permit the safe recovery of the whole seam by pillar extraction or longwall.

The necessity of leaving so large a percentage of the coal seams intact naturally introduces a grave economic disability in reducing the amount of coal available for production. At the same time it increases enormously the amount of costly development necessary to maintain large producing collieries, in addition to aggravating the problems of transportation and ventilation.

Mechanical Loading

To reduce the high cost of operation due to this disability, the Corporation has progressively mechanized all its underground services. In the years 1928 to 1932 it experimented with mechanized loading units, introducing a "Duckbill" operation in No. 1B and No. 4 Collieries. These first attempts, because of the difficult physical conditions and the reluctance to use electricity at the coal face, were not

Fig. 4. Arched Tunnel showing Diesel Locomotive.

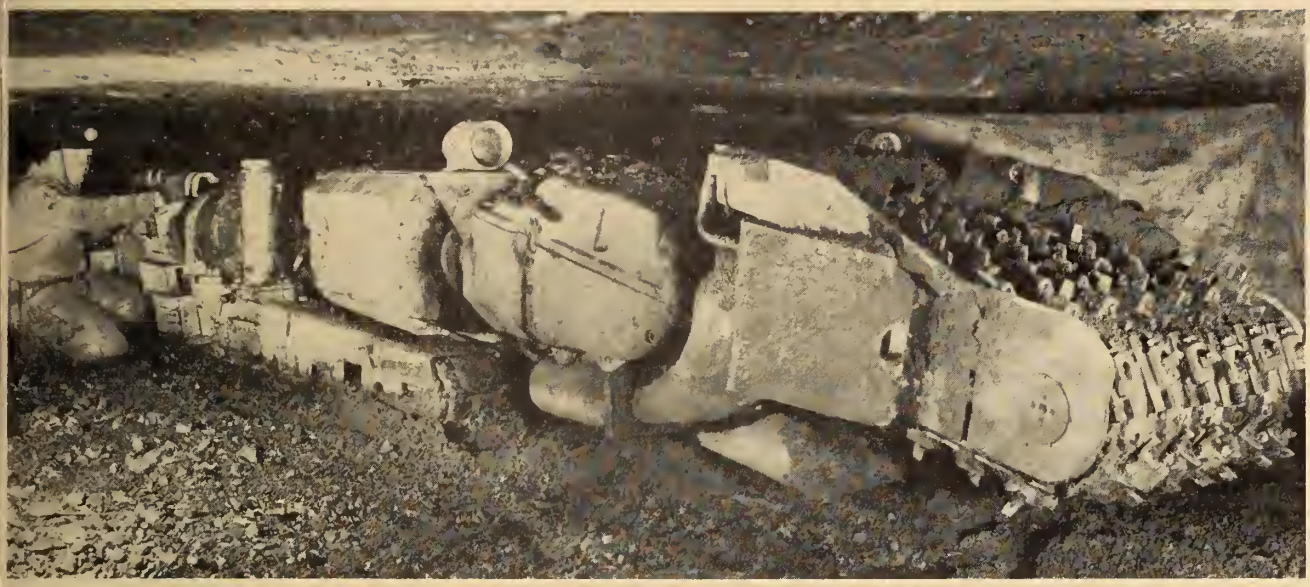

Fig. 5. Room Continuous Miner.

successful. A later attempt was made to introduce mechanical loading in the pillar and room operation at No. 20 Colliery, using Joy loaders. This also failed because the workmen in the field were not ready to accept complete mechanization.

In 1947 and 1948 a further attempt was made to introduce mechanical loading into the collieries. Joy loaders were introduced for development work in Princess Colliery, and for a regular pillar and room operation in No. 20 Colliery. In view of the prospective development of the Continuous Miner for longwall, the Joy Loader operation at Princess Colliery has been held up. This colliery is now operating at a depth where longwall, with full recovery of the seam, is successfully pursued. In No. 20 Colliery, however, which is operating at a shallower depth of cover, the introduction of Joy loaders has met with reasonable success. Six Joy loaders are now in operation.

Difficult roof conditions have somewhat limited the full measure of success expected. A new development in roof support, introduced by the Company last year in the form of roof bolting in the rooms, promises encouraging prospects for improved success. Mechanical loading has been further extended in the field, and a Joy loader operation has now been introduced into No. 25 Colliery and is showing promise of success.

Pillar Recovery

As the workings progressed seaward and the depth of cover increased to a point where total extraction was possible, the pillars were recovered in the undersea workings. Total extraction by pillar drawing, giving a recovery of from 80 to 90 per cent of coal, depending on the local physical conditions, can be worked under moderately heavy cover. In Cape Breton the point where it is no longer possible to maintain a successful pillar operation, due to the heavy loading on the pillars, lies at a depth of 1,600 to 1,700 feet. Beyond this depth the only possible method of operation is longwall. In certain collieries of the Corporation in Cape Breton we are now operating at a depth of 2,450 feet.

Recognizing the limitations and wastefulness imposed by a room and pillar operation, the Corporation introduced a system of longwall in 1925. As was natural, there existed a strong prejudice against change in the method of mining long established in the field. Two previous attempts to introduce longwall in the area at Princess Colliery in 1889 and in No. 10 Colliery in 1902 had been abandoned.

Longwall Operations

However, as those engaged in the operation gained understanding and became familiar with the system, prejudice gradually died out. In the ensuing years a fine system of longwall has been developed, and at this time approximately 60 per cent of Cape Breton coal comes from longwall operations.

A longwall unit produces from 400 to 500 tons of coal per shift, and is self-contained in all its services.

In this system the coal is cut and conveyed mechanically from the operating face to a belt conveyor unit located in a branch roadway off the main entry. From this point the coal is transported to the surface through a system of rope and locomotive haulages. These haulages on the inclines develop up to 1,800 H.P., with speed of hoisting up to 40 ft. per second. They are the largest underground hoists used in coal mining in the world.

Further to eliminate rope haulages on subsidiary levels, the Corporation is introducing 100 horsepower Diesel locomotives. One of these units is now operating successfully in No. 18 Colliery, and we are installing six additional Diesel locomotives this year (Fig. 4).

The longwall operations of the Corporation have reached a high standard of efficiency, with all operations except the final operation of loading into conveyors being mechanized. To round out the mechanization policies of the Corporation, an investigation was made in 1946 into the available longwall loading equipment in Europe. None of these, however, fitted the difficult physical conditions existing in our Cape Breton Collieries.

Silver Continuous Miner

At this time the Corporation had the opportunity to examine a machine known as the Silver Continuous Miner in the U.S.A., adapted to room and pillar mining. While this machine was not suitable for longwall operation, the principle could be applied to a longwall machine. The Corporation therefore entered into an arrangement with the owners of the patent rights, whereby the Company would deve-

lop a machine suitable to a longwall operation.

The Corporation engineers and designers within a period of one year developed a trial machine, which was put into operation in No. 18 Colliery. From the experience gained in the operation of this machine, a new machine has been developed which is now operating successfully in No. 18 Colliery. A total of 13 Continuous Miners are expected to be in operation before the end of the year (Figs. 5 and 6).

In a fully mechanized operation, the problem of coal cleaning is of paramount importance. The Corporation has been fully alive to this problem, and a study has been made into the best possible type of washing unit suitable to our operation. The Company has already let contracts for the erection of a plant at Sydney Mines of the MacNally-Norton type, capable of handling 325 tons per hour through a 6-cell unit. The plant will prepare four sizes of coal: 0-¼″ + ¼; ¾″ + ¾″; 1¾″ and +¾″-6″; and will include an oiling unit for domestic coal.

A wash plant is also being designed to take care of the whole output of the Dominion Coal Company. This is believed to be one of the largest plants in the world, designed to treat 40,000 tons in 24 hours. Preliminary surveys are already under way for the plant site, which will be located on the outskirts of the City of Sydney.

Mechanization of our surface plants and reorganization of the collieries has also been studied. At No. 4 Colliery, sunk in 1866, a new concrete lined ventilation shaft, 18 feet in diameter, has already been sunk and equipped. The surface is being electrified and the old steam plant abolished.

At Princess Colliery a new 18 ft. wide semicircular tunnel, 3,600 ft. long and pitching at 20 per cent, will be started this summer, which will reach from the surface to the pit bottom. This tunnel will be equipped with a 36-inch belt conveyor to convey the coal from tipples in the pit bottom directly to the wash plant. It is planned to increase the tonnage from this colliery from 2,000 to 4,000 tons per day. The tunnel will also be equipped to convey men and material underground.

Conveyor Belts and Slope Tunnels

The distance of the workings from the surface imposes a severe disability in the time available for work on the producing units. The working shift is eight hours, but the effective working time is only six hours. To minimize this disability, and to improve the transportation system in those collieries where distances are very long, the Corporation is planning the centralization of output and simplification of the transportation systems. This will be done by introducing, as in the case of Princess Colliery, conveyor belt systems that will take the coal directly to the surface. At the same time this will permit a more direct and speedy conveyance of the workmen to the producing faces.

To this end, the Corporation is reorganizing No. 4 and No. 20 Collieries, which are working in overlying seams within the same area. The output from these collieries will be increased from 5,000 tons to 10,000 tons per day and will be delivered to the surface through one opening. To accomplish this a semicircular slope tunnel, 19 feet in width and 6,225 feet long and pitching at 18.8 per cent will be driven from the surface at No. 2 Colliery to strike a set of horizontal tunnels 3,400 feet long. This slope tunnel will be driven to connect with our existing tunnels connecting the Phalen and Harbour Seams in No. 2 Colliery.

A tunnel 4,000 feet long, pitching at 20 per cent will also be driven to connect the workings of No. 20 Colliery with the workings in No. 4 Colliery. The output from both collieries will be delivered by rope and trolley locomotive haulage to the foot of the new slope tunnel. Here it will be passed through tipples feeding a 54 inch belt, to be installed in the slope tunnel. In this tunnel provision is also being made for the transportation of men and material.

The total cross measure drivage amounts to 2¾ miles, and will cost approximately $2½ millions. Arrangements are being made to start the first stage of development this year. Our planning calls for the completion of this development in a period of five years. When it is completed we will have the largest and most modernly equipped colliery unit in Canada. √

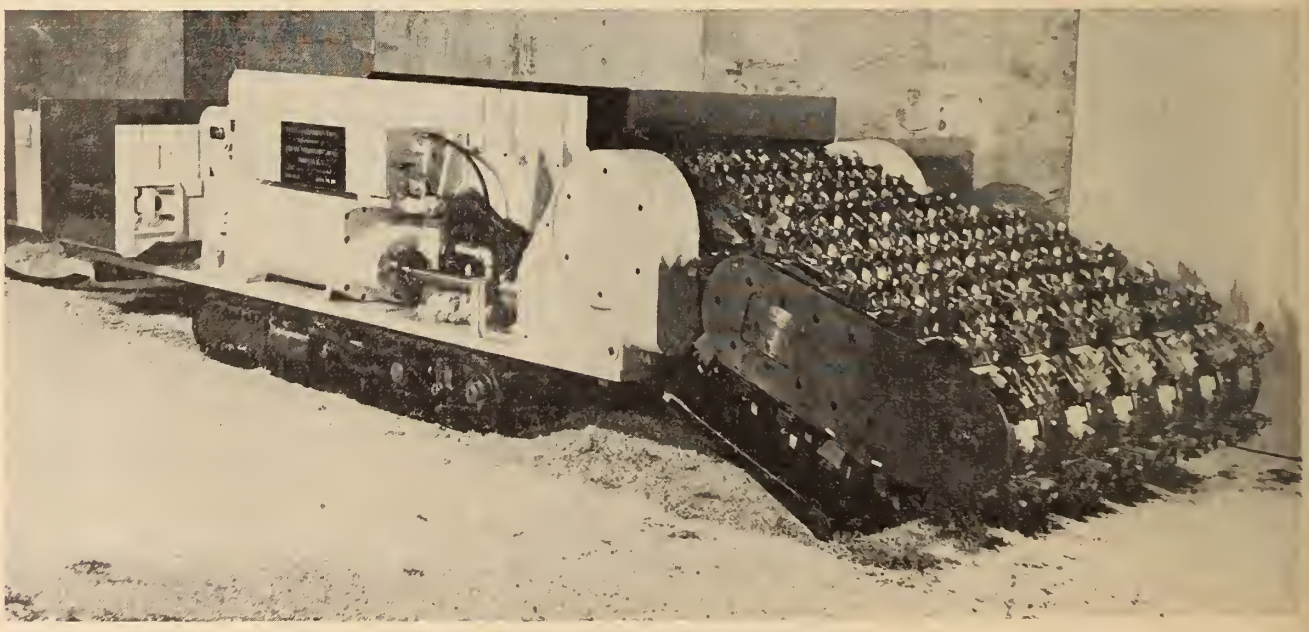

Fig. 6. Dosco Continuous Miner.

The Montreal Master Control System of the C.B.C.

by

R. H. Tanner

Audio Engineer,
Communications Equipment Division,
Northern Electric Company Ltd.,
Belleville, Ont.

When the Canadian Broadcasting Corporation recently centralized its local services and national and international networks at Montreal in the former Ford Hotel, a master control system had to be set up. The control equipment comprises the largest master control set-up on the North American Continent today, exceeding those at Radio City, and the Don Lee System at Hollywood.

Outlining the various services the new centre is called upon to perform, this paper describes the mechanical construction of the equipment installed and discusses in turn the functioning of the master control system, switching system, cue selectors, volume indicators, amplifiers, jackfields and the recording and house monitoring systems.

Design and manufacture of this installation, with minor exceptions, has been entirely Canadian.

The new Master Control equipment, recently installed for the Canadian Broadcasting Corporation in Montreal, forms the largest Master Control set up on the North American Continent. It seems appropriate to outline the problems which faced the C.B.C.'s Plant Department as a result of the decision to turn the former Ford Hotel into a consolidated studio centre.

Until the acquisition of the Ford Hotel, the C.B.C.'s Montreal activities were carried on in several different locations. In particular, the studio facilities for the national networks and local transmitter programmes were quite separate from those used for the international services. In addition, neither was adequate for the growing needs of the two services. When the new broadcasting centre was planned, therefore, it was decided that it should contain 15 programme studios, and five transmitter studios. These latter are provided to serve the two C.B.C. Montreal transmitters CBF and CBM and two international programmes, leaving one spare in case of failure. In addition, one external studio, a large hall used especially for audience participation shows was retained, and considered in almost every respect as a sixteenth internal programme studio.

Apart from the Studios, other sources which had to be provided for included networks originating either in Canada to the East or West, or from the United States. Included as well were many remote pickup points, some temporary, some permanent, around the city and suburbs of Montreal itself. In the same way, feeds had to be arranged to the outgoing network lines, to the recording room and, for cueing purposes, back to the studios themselves. In addition, with all the C.B.C. Montreal offices at last under the same roof, an extensive house monitoring system became necessary. This was required so that officials in their

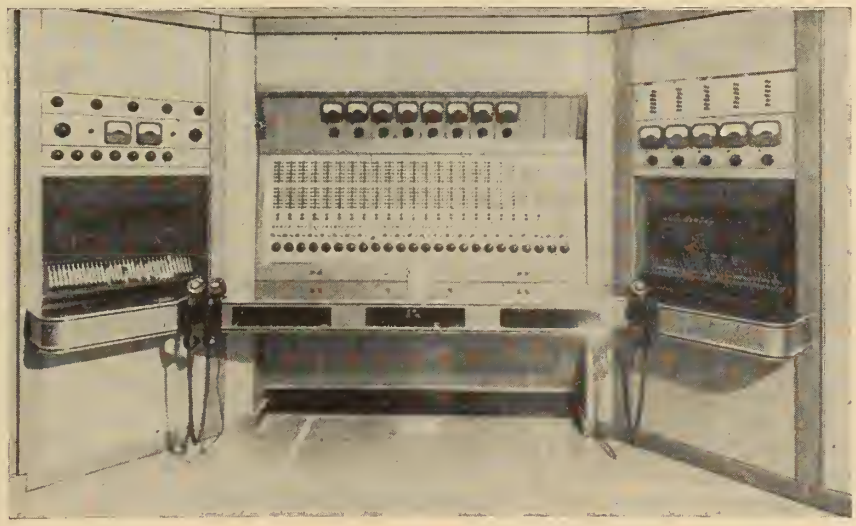

Fig. 1. View of the central section of control equipment

offices could listen to and check the manifold programmes which were circulating around and through the building.

Performance and Economy Important

This then, is the broad picture which the C.B.C. Plant Department, in collaboration with their Operations Division, had to reduce to a concrete specification. Its purpose was to achieve not merely an arrangement which would do what was required of it, but one which would do it in the most economical way, and with the least attention from operators. Their final plans were in three separate sections. First, a master control equipment capable of accepting programmes from a total of 24 Studios (both programme and transmitter). This was composed of seven incoming network lines and a large number of remote points, these latter of course on a patching basis. Outputs were to be provided on the following basis:—Eight outgoing networks, five main transmitters with provision for feeding auxiliary FM or short wave transmitters, relay companies, etc., and fifty programme feeds to both the recording and house monitoring switching systems.

Additional features to be included comprised a very complete radio receiver set up for monitoring off the air, a cue selector for feeding any one of 24 different programmes back to 33 studios and foreign language booths. Also included was a system which used two volume indicators and three loudspeakers, to provide monitoring over a choice of sixty different locations within the complete set up. Provision was to be made for increasing the number of incoming networks to nine, and outgoing networks to twelve.

The recording switching system, which formed the second section of the master plan, provided for fourteen recording machines with possible extension to twenty. Each machine was to be provided with a control panel giving instantaneous selection of one of the fifty programmes from the master control set-up, together with some form of lamp indication that the correct switching had been effected. The house monitor system, the third part of the complete plan, had similar requirements except that there were to be fifty stations and the lamp indication was unnecessary.

Why was it that the C.B.C. should need so vast a set-up, considerably bigger than the master control room in Radio City, New York, and even exceeding in total extent the recently erected Don Lee system in Hollywood? A moment's thought shows that while most of the American stations are concerned with, at most, three networks (and this only when they are acting for the U.S. Government in the Voice of America Broadcasts), the C.B.C.'s programme commitments are seldom less than five. Over and above the International Service which is often duplicated, there are the Dominion, Trans-Canada and French Networks, each of which may split in two, so that altogether the arrangements provided may not appear quite so lavish.

With that introduction, we can pass on to a description of the equipment produced to fulfil the C.B.C.'s needs, and which is now installed in three rooms in the Radio Canada Building. The master control room itself, of course, houses the main control board, together with the racks carrying all the amplifiers, jackfields, receivers, test equipment, etc.

Equipment

At this point, something may be said about the mechanical construction of the equipment. Owing to the location of the control room on the second floor, everything had to be kept as light as possible. For this reason the racks are all of a very strong, but simple design in sheet metal. Partly for convenience in assembly, and partly to distribute the load over as great a floor area as possible, they are self-supporting with a base projecting towards the rear. In the complete equipment they are bolted together side by side, with a small gap in between, which is used in securing the style strips.

This new design has proved satisfactory even when loaded with six heavy rectifier units. Only two widths of rack are used throughout; the standard 19-in. size, and a wider 30-in. rack. The latter was designed to hold the "crossbar" switches used on the recording switchgear together with their attendant terminal strips, was also used for the two "wings" of the central control position, as well as, in modified form, for the battery and rectifier rack, and the frame

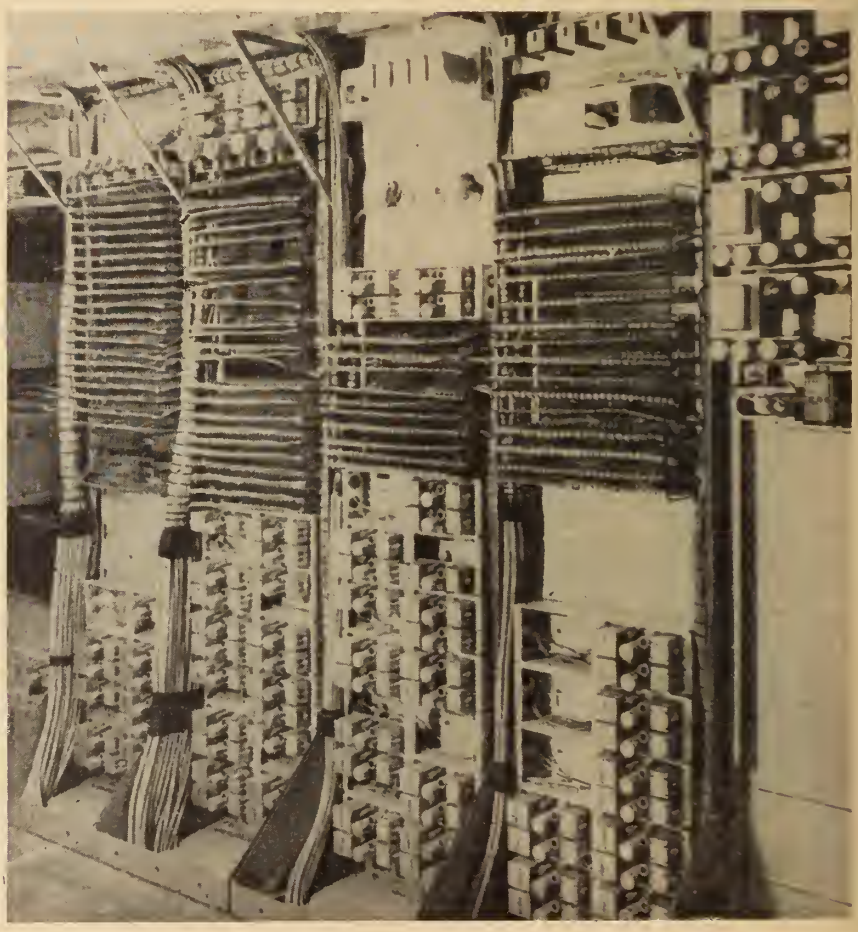

Fig. 2. Rear view of the line and incoming network jackfields

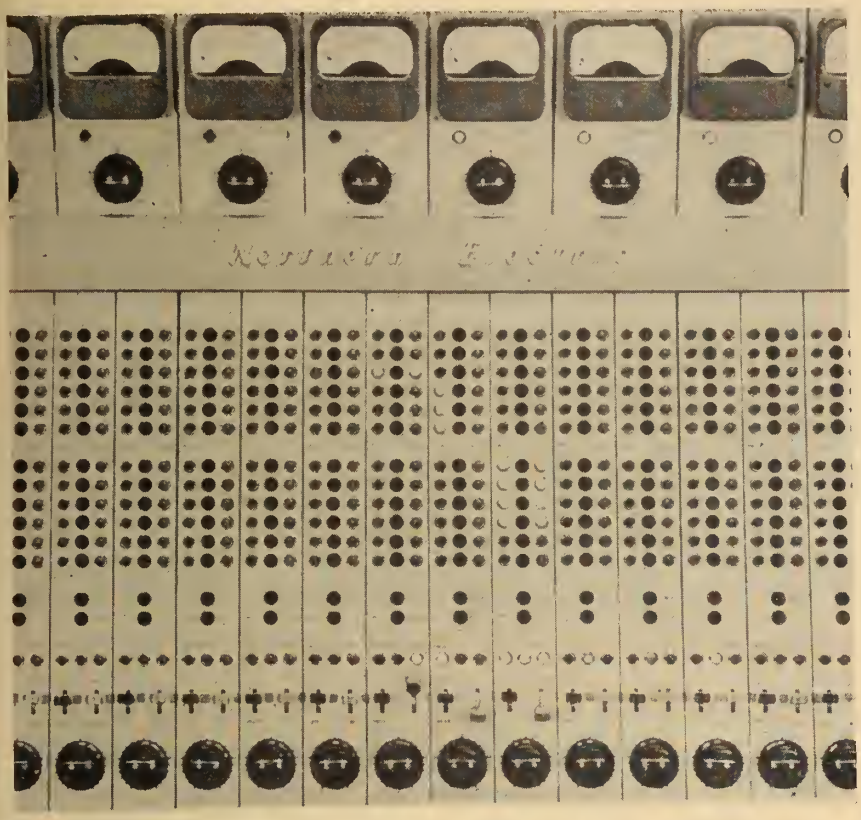

Fig. 3. Portion of main control panel, with small output panels above

of the door which gives access to the Main Equipment.

Figure 1 shows a close view of the central section of the equipment. The main control panels, hinged at the bottom for easy maintenance, are carried on outriggers on three of the standard 19-in. racks mounted side by side, and carrying the relays, repeating coils, etc. The whole central position is tied together by a strongly constructed table, the middle portion of which contains three large glass covered cavities, intended for schedules, log sheets, etc. One last little item of mechanical interest refers to the two cupboards on either side of the Control position. These serve to store patchcords away tidily, and also contribute considerably to the general styling.

Associated with the master control equipment proper, but located in the equipment room immediately below, is a standard telephone type distribution frame to which all the external connections are brought. In addition, a large number of the internal connections, such as those to the inputs and outputs of all the amplifiers, are brought down to this frame. If and when it becomes necessary to reallocate circuit functions, this can be done by altering the jumpering on the frame, rather than by disturbing the wiring behind the jackfields.

Almost all programme wiring throughout the whole equipment is carried out in multi-conductor telephone cables, with practically no shielded wire being used anywhere. While this represents a tremendous saving in installation time and in space required, it results in a great problem in the avoidance of cross-talk and noise. This has been overcome by sound engineering and careful circuit design. Fig. 2 shows a rear view of the line and incoming network jackfields. This gives an idea of the large amount of cabling involved; with shielded wire, the cable forms would be almost unmanageable.

Also in the equipment room are the recording crossbar switches and the house monitor selectors, as well as the voltage-regulated rectifiers which supply the programme amplifiers throughout the main equipment. Batteries supplying all the relay and lamp circuits are kept float charged by grid controlled rectifiers. They are housed in a separate and well ventilated little room. The reason for the use of batteries is to prevent minor power failures from releasing all the relays, which in any pre-set system such as this would have serious consequences. For the same reason, a double fusing has been arranged for the main switching system in such a way that the system will continue to work even after either one of the two fuses has blown.

Master Control

The incoming network lines of the master control system are connected to bus bars, across which seven amplifiers are bridged. An eighth amplifier, feeding the cue selector, is connected on the input side of the associated volume control. The first five of these amplifiers are normalled through jacks to line input terminals on the consoles of the five transmitter studios. The operators of these consoles therefore have the main incoming networks available to them at all times. The other two ampli-

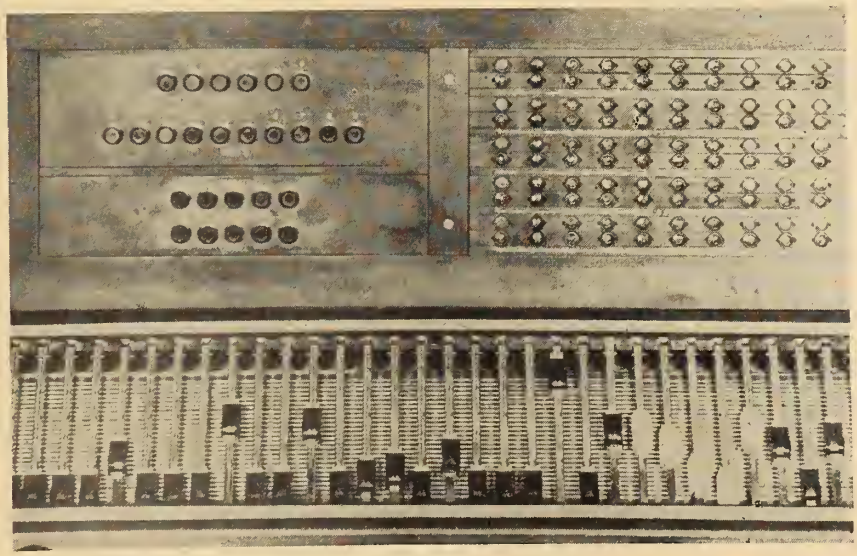

Fig. 4. Control panel for monitor and V.I. selector, with cue selector below

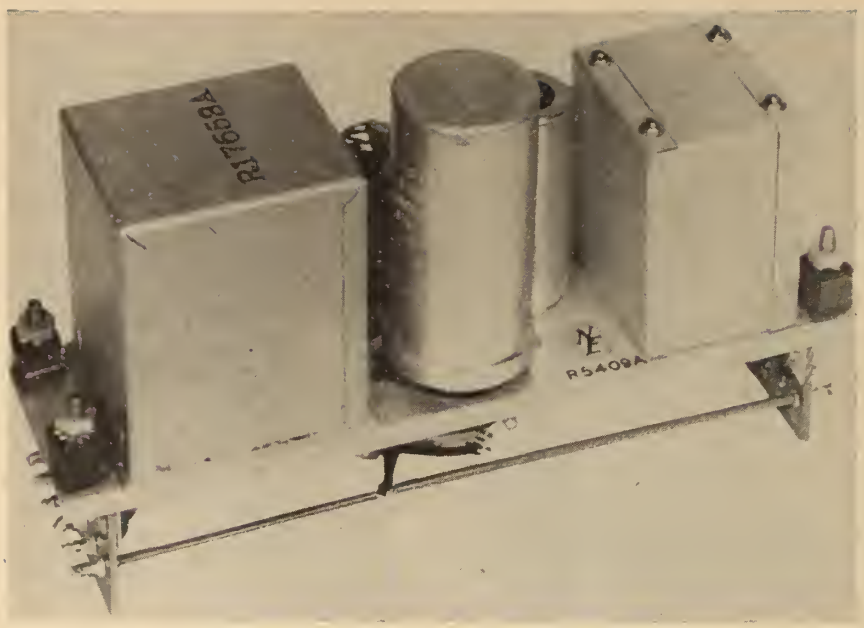

Fig. 5. Miniature programme amplifier

fiers feed the house monitor and recording switching systems.

The network outputs of all the studios, transmitter and programme, are taken to the corresponding inputs of the main switching system, with feeds to the recording system bridged off. On the transmitter booth consoles, a second output is taken through a transfer switch, which allows any booth to work with any transmitter to another bus-bar system. This, in turn, feeds the main and spare outgoing lines, as well as such auxiliaries as the F.M. transmitter and wire relay companies.

A monitoring circuit is taken across the main outgoing feed both to the cue selector, and, through the transfer switch, back to the console. Thus the operator's normal check is on the programme material actually being fed to line. In the same way, the order wire, as well as the control circuit of the loop reversal relay, is taken back through the transfer switch to the transmitter studio concerned. The foreign language booths, the inputs and outputs of which appear as jacks and are patched as required, are used in connection with the C.B.C. International Service for inserting foreign announcements in musical programmes, etc.

The outputs of the main switching system are once again arranged on a bus-bar system, with bridging amplifiers feeding the outgoing lines as well as further inputs on the transmitter studio consoles. This makes outgoing as well as incoming networks available to the local transmitters.

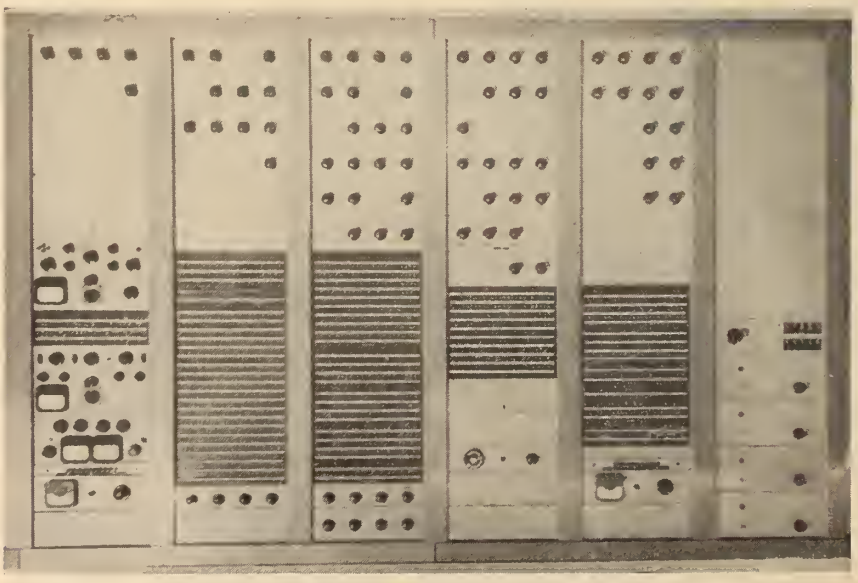

Fig. 6. Front of equipment, showing volume control mounting and jackfield construction

Switching System

The main switching system is controlled by a large panel, a portion of which is shown in Figure 3. In the design of this system, the problems of the operator have been kept clearly in mind, since he is going to be faced, usually alone, with the supervision of the whole equipment. It is important that even his thinking should be kept as simple as possible. For example, in nearly all the recently constructed master control rooms of any appreciable size, the switching is arranged on an "output" basis. That is to say, there is a separate panel provided for each output, with some means of deciding which input it shall be fed from.

This means that before any programme change, the operator must consider each output in turn, deciding whether its source changes *or not*. Thus, there is a considerable amount of "negative" thinking to be done. On the other hand, the switching in the C.B.C. System is arranged on an input basis, with a separate panel for each of the 24 studios. In this case, before a programme change, the operator sees from his schedule that a certain show is starting up in Studio X, and is to be fed to such and such outputs. His attention is thus concentrated on the Studio X panel, and by pressing the necessary output buttons, the pre-setting is accomplished.

Another advantage of the methods employed is the great economy in the number of relays used. Descriptions of the Don Lee control equipment mention over 800 relays for a 13 x 27 switching system. For a board of the same size, the system under discussion would require only 391. In practice, the C.B.C. equipment uses a total of 224 in its present state of eight outputs and twenty-four inputs, a figure which will increase to 324 if and when the remaining four output circuits are equipped to give a 12 x 24 system.

The main reason for this lies in the use of what are known as "cumulative locking" push buttons to provide the preset memory. These buttons are of the type in which each one pressed remains down until they are all released by

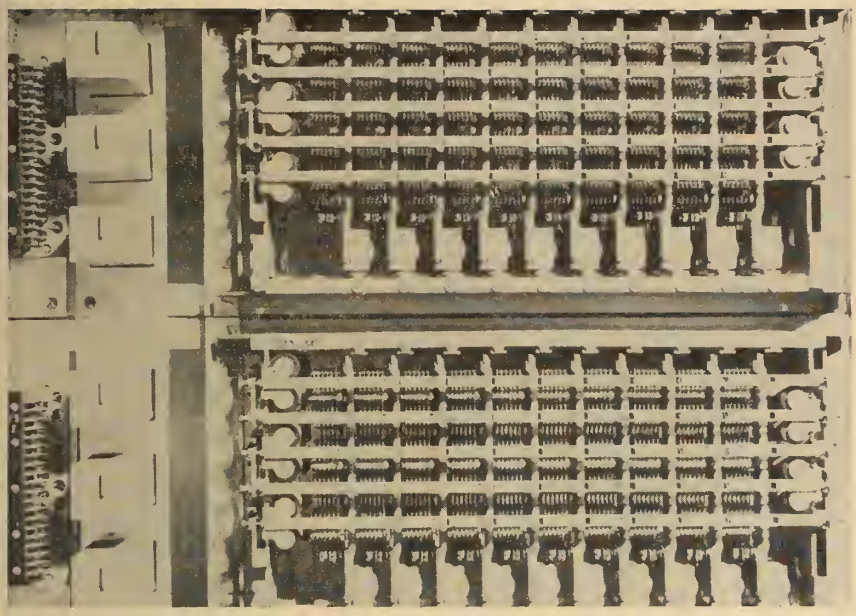

Fig. 7. Crossbar switches serving recording positions

Fig. 8. Recording machine control panel

a separate "release" button. Former systems tended to employ non-locking buttons which operated what we may call a "memory" bank of relays equal in number to those required for performing the actual switching.

Thus, during the period between the pre-setting operation and the actual switching, the input panel under discussion will have some of the push buttons depressed, corresponding to the outputs to which this input is to be connected. Because the position of the buttons is not too obvious at a glance, they are made to control amber lamps adjacent to them, so that the pattern of amber lamps on the whole board is the pattern of pre-setting. Incidentally, there is nothing to prevent one output being pre-set on several inputs at once. This would be a very definite advantage in cases where spot announcements, station breaks, etc. are inserted in the programme by means of master control switching, as is done in many U.S. Stations. The C.B.C. practice of using transmitter studios for this purpose, however, means that in their case this advantage is not an important one.

At the actual moment of switching, a circuit is closed in one of several different ways which will be described later. The current passes through the contacts of the push-buttons which have been depressed to the corresponding relays which operate, making the desired programme connections. At the same time, however, they perform a number of other functions. First, they all lock up over their own contacts in such a way that releasing the push buttons has no effect. Second, they cause guard relays for each of the outputs concerned to close, thereby preventing any other relays in the same rows from operating. This ensures that no two inputs can be connected simultaneously to the same output.

Third, they feed current to a slow acting relay associated with the particular input which, some ten seconds later, disconnects the circuit to the push buttons. This means that pressing additional buttons (as might be done, for example, when pre-setting a new arrangement) will no longer have any effect. Lastly, each relay lights a green lamp alongside its corresponding push button, on the opposite side to the amber lamp already mentioned, to indicate that the desired switching operation has been effected. If the green lamps match the amber ones, all is well. If not, then one relay may have been locked out because the output was already in use on some other input.

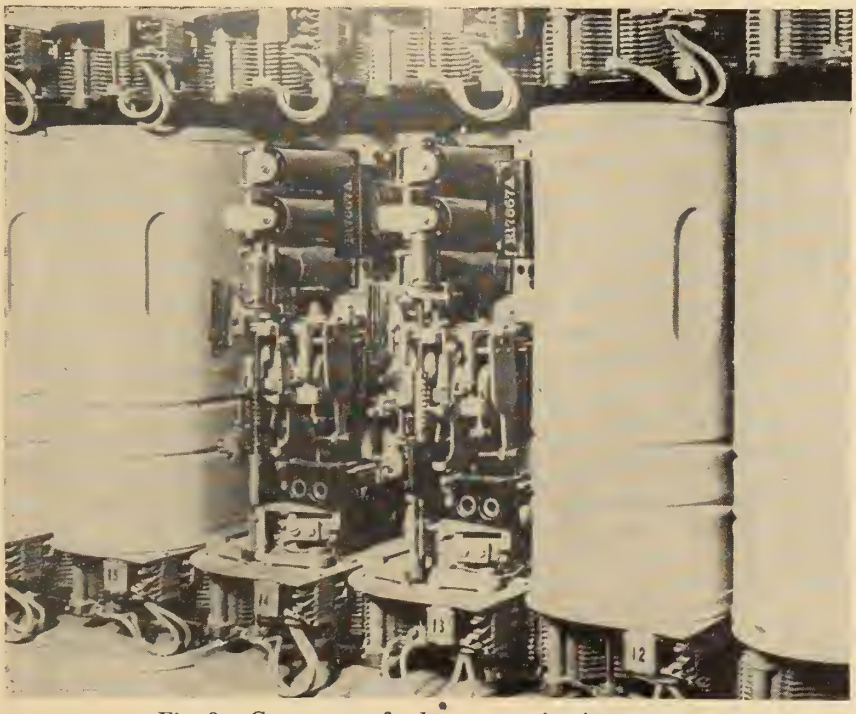

Fig. 9. Connectors for house monitoring system

Initiating Switching Operation

The question of how this whole switching operation is initiated may now be discussed. At the bottom of the panel, below the push buttons, are two keys. By throwing the right hand key to the "Solo" position, the master control operator can do the switching for this one input locally. In this case green "ready" lamps will be lit both on the input panel immediately above the keys, and on the console of the studio concerned. When the studio operator throws his output key to start the programme, red "accept" lamps will light in both locations. Alternatively, if there are several switching changes to be made at once, the master control operator can move the left hand keys of several panels to either the Group 1 or Group 2 positions, when complete control of the inputs concerned will be concentrated in one of the two group keys on either side of the clock.

As a third alternative, and one which will probably be used most often, the master control operator can set the right hand key in the "Studio" position, when the amber "Studio Preset" lamps will light both on the input panel and on the studio console, but no switching will take place. The studio operator now has control, and when he makes his output key, the switching takes place and the red and green lamps all light, to indicate this. Thus, under normal conditions, the master control operator's functions are to perform the necessary pre-setting, after which he may leave to the studio operator the actual switching at the correct moment.

So far, we have been considering only the act of starting up a programme all on its own, without considering what has been happening just before. As far as the National Networks are concerned, the standard 20 second network break which separates successive programmes will mean that output circuits will normally be released 20 seconds before they have to be picked up again. On the International Service, however, direct changeovers with no break are often called for. Here we may have the situation that the operator in the studio which is just finishing may be rather slow in relinquishing his control. This means that, when the next operator throws his key, the lockout circuits prevent his relays from operating. If the overlap period during which both studio keys are down is less than some 5 to 10 seconds, the action of the dash pot relay, mentioned earlier, is such that the switching will be automatically completed as soon as first studio releases. When the overlap is longer than this, as for example, in the case of a programme definitely overrunning, the second programme may be started on time. After the first one has ended, the master control operator may effect the switching at a suitable moment by pressing the "Late Entry" button which for a moment energizes the buttons again.

Figure 3 also shows small output panels above the input panels, on each of which are mounted a volume indicator, an attenuator and a green lamp. This last named indicates when the output concerned has been connected to one or other of the inputs. A quick glance along the row is enough to tell the operator which outputs are energized. The volume indicator and attenuator are connected respectively to the output and input of the amplifier feeding this particular line, so that any errors in levels may be detected and if necessary corrected.

Cue Selectors

Although the switching system just described is, of course, the heart of whole master control equipment, it is by no means the only switching system included in the whole set-up. It is not even the largest, if we define size as the product of inputs and outputs. In the main system there are 24 x 8 or 192 crossover points, while in the cue selector, the corresponding figures are 26 x 33 or 858 and the selection is accomplished without the use of a single relay. Fortunately, this apparatus is used solely for feeding cue programmes to the control rooms of the various studios. Thus certain liberties can be taken which would be impossible with actual programme material.

The switching is carried out in a direct fashion, as each input is taken to one of the bars of what may best be described as a flat commutator. Mounted above this and at right angles to the bars are rods, one for each output, carrying sliding contacts. These may be moved to connect with any one input bar. Numbers on the rods serve as a guide to the desired setting. Electrically each input is fed through its own amplifier, and each slider is connected to a bridging transformer and thence to the line to the studio. The result of this design is an extremely compact and simple-to-operate selector.

The requirements for visual and aural monitoring call for two volume indicators, three loudspeakers and amplifiers, and a switching system capable of connecting these five devices to any of sixty different inputs taken by bridging across various points in the system. In order to avoid any serious errors on the part of the master control operator which might be caused by mistakes in working this monitoring system, the C.B.C. called for positive indication, as in the Recording System, that the desired connection had in fact been achieved. Selection and indication are accomplished by a system which employs three "crossbar" switches of the type now being used in the latest type of automatic telephone exchange, controlled by means of push buttons.

In the case of the Monitor and V.I. Selector, the control panel, which forms the upper half of Fig. 4, mounts four rows of buttons. The top two rows are for the tens and units of the code number, while the third and fourth rows "operate" or "cancel" the various monitoring devices. For example, if the operator wishes to check the output of Studio 28 both visually and aurally, he presses button No. 2 in the top row, No. 8 in the second, and then the "operate" buttons for one of the volume indicators and one of the loudspeakers. The connection will immediately be made and the indicating lamps will light in the adjacent panel.

It should be pointed out that the use, throughout the whole installation, of so many different switching systems depending on a two digit code required a careful choice of numbering system to avoid conflicting allocations. In the system adopted, numbers from 01 to 08 were allotted to the language booths, 10 to a test tone, 11 to 34 to studios, 41 to 49 to incoming networks and so on.

Volume Indicators

At this point it seems appropriate to describe the extremely useful "extended range volume indicators", of which a total of seven are used throughout the equip-

ment. These instruments each consist of a standard V.I., a very stable little amplifier, an attenuator giving 60 db. attenuation to 2 db. steps and an input transformer of such a size that it can be bridged across a 600 ohm circuit carrying +30 dbm without saturating.

The whole arrangement, therefore, forms a volume indicator which may be set to read any programme level from —30 to +30 VU for standard deflection, while useable readings will be obtained for programmes even lower than —30 VU. These units proved really invaluable, enabling such things as amplifier gains and system response curves to be measured extremely rapidly, without resorting to the use of the more elaborate test gear provided.

One other small switching system included in the master control equipment proper requires only a brief mention. It was not considered practical to associate definitely each transmitter booth with one particular transmitter, nor even to designate one booth as a spare. Thus it was necessary to arrange that any booth could be switched through to any transmitter, and this was done by means of a straightforward pushbutton arrangement. The main complication here is solely due to a multiplicity of contacts. As already mentioned, in addition to the actual programme circuit, the order wire and the control wire to the line reversal relay have to be switched, as well as the circuit which provides the booth with a monitoring feed direct from the outgoing line.

Amplifiers and Jackfields

Before passing on to the recording and house monitoring systems, there are one or two other features of the master control equipment which should be mentioned. First, the amplifiers; quite apart from monitoring and V.I. amplifiers, there are 180 programme amplifiers in the complete set-up. All except nine of these are identical. The remaining nine differ only in the wiring of the input transformer to give a 600 ohm input and increased gain. It is obvious that unless each unit is fairly small, 180 of them will take up a lot of room. A miniature programme amplifier (Fig. 5) was developed especially for this job. The amplifiers were mounted four to a chassis, with the volume controls mounted on the mat as shown in Figure 6.

Figure 6 also illustrates another new feature of this equipment, namely the jackfield construction. The complete equipment includes a number of jackfields, all differing in size and build up, but none of them encumbered by a multiplicity of different sized mats. This has been achieved by a unitized system in which the front of the jackstrip is flush with the mats of the adjoining equipments (thus eliminating the need for mats). This is so arranged that any size of jackfield may be built up, with wide and narrow designation strips included if required.

On the subject of jackfields, it should be mentioned that as originally conceived, the equipment was to include precisely twice the number of jacks that it does now. However, the C.B.C. have followed the examples set by the B.B.C. in England and the C.B.S. in the States, and adopted single jacks throughout, with, of course, a tremendous saving both in space and cost. One interesting point is that the jacks were made in the States, the plugs in England, both perfectly standard parts; one of the few instances of international interchangeability.

Recording and House Monitoring

The recording switching system is identical in principle with the Monitor and V.I. Selector which has already been described. Each crossbar switch, of which two are shown in Fig. 7, serves two recording positions, giving each of them a choice of 50 programmes. Selection is made in this case by means of two rotary switches, one for the tens, the other for the units and the same lamp indication is provided. Fig. 8 shows the control panel, one of which is associated with each recording machine.

As the Recording Room is some two hundred feet or so from the recording switchgear, it was desirable to keep to a minimum the number of interconnecting wires. The number was restricted to 20 per panel, 16 of which are required for the lamps alone. It is obvious this system removes a great load from the master control operator, since the recording technicians can perform their own programme selection in all except the most unusual cases.

In the house monitor system, which will have control stations scattered all over the building, it was even more imperative to reduce the number of control wires. Since no lamp indication was required, it was found possible by the use of a dialling system to restrict the control circuit to two wires and a ground. The use of a dial for this system has the additional advantage that it is a piece of equipment with which every member of the staff will already be familiar.

Operation has been reduced to the simplest possible procedure. To obtain a given programme, dial two digits. To change the programme, dial two more digits. To silence the loudspeaker, press the cancel button; if a mistake is made in the first digit, press the cancel button and start again. If a steady tone is heard, dialling is incomplete: either dial another digit, or press the button and start again.

However, although the operation is simple, the methods of making it so were not. The main design difficulty lay in the fact that while the normal dial telephone always has some form of hook switch, the operation technique desired did not allow for any equivalent. The telephone, therefore, always gets a signal to indicate that the subscriber is going to start dialing.

In the case of the house monitor system, the equipment, although in a quiescent state and passing no current, had to be ready to respond at once to dialling, count out two trains of dial pulses and then as it were, go to sleep again, but as before with one eye open. Figure 9 shows the connectors developed to perform this function, including the three control relays and the bridging transformer feeding the line.

At the time of writing, the equipment had been in full operation for over one year and has been giving satisfactory service. The technical performance of the whole system is of a very high order with total harmonic distortion averaging well under 0.5 per cent and noise levels around 75 to 80 db below rated output. Cross talk in general has been reduced to a point where it is masked by the noise, which in view of the low noise level represents a considerable achievement.

In conclusion, it may be mentioned that the conception, development, design and manufacture of the whole installation is entirely Canadian, with the exception of such standard items as test gear, power supplies and the smaller components. ✓

Report of Council For the Year 1951

Together with Committee and Branch Reports

The year 1951 was a good one for the Institute. There was an expansion in activities and an improvement in the financial position. All branches record successful seasons. The industrial expansion of Canada has created new opportunities for engineers, and as well has created substantial shortages of engineers, all of which has been reflected in the Institute's activities.

New Branches

The year saw the opening of four new branches at Rimouski (the Lower St. Lawrence Branch), Sherbrooke (the Eastern Townships Branch), Fredericton, and Charlottetown (the Prince Edward Island Branch). The president presented the charter on each occasion.

Council

Council met eleven times with four meetings at Montreal and the balance at Shawinigan Falls, Niagara Falls, Toronto, Halifax, Rimouski, Sherbrooke and Fredericton. The average attendance was twenty-three. It is interesting to note that there was no meeting in Montreal from May until January, 1952.

Engineers' Council for Professional Development

The activity of various Institute representatives on the many committees of the Engineers' Council for Professional Development was maintained throughout the year. At the annual meeting held in Boston all committee representatives were present, and profited greatly from the experience. A special meeting of Institute representatives was held in Toronto in December.

Presidential Visits

The president, Dr. Ira P. Macnab, visited the branches from Lakehead in Ontario to St. John's, Nfld. The four western provinces will be covered in April on his way to the annual meeting in Vancouver. Up to the end of this year the president had attended every meeting of Council.

Upadi

In April the Institute participated in the inauguration of the new Pan American Engineers Conference held at Havana, Cuba, now known as UPADI. At that time James A. Vance was president and along with the general secretary represented the Institute. The membership of the conference embraces seventeen countries including the United States which was represented by delegates from the five leading engineering organizations.

Field Secretary

The field secretary and his office at Toronto had a busy year. The usefulness of this Headquarters branch has been expanded greatly not only in Ontario but in many other provinces as well. One unexpected development has been the opportunity to render an employment service there. Another development which is the result of Col. Grant's interest in E.C.P.D. has been the establishing of courses of lectures for young engineers at several branches. This project shows signs of spreading into all provinces.

Headquarters Staff Changes

In August the assistant general secretary W. D. Laird resigned to go into sales work. The Institute was indeed fortunate to secure the services of Col. H. G. Thompson who by the year's end had the new responsibilities well in hand. He is well known in all parts of Canada and is excellently well suited to his new duties.

Expansion in Co-operation

The year saw the inauguration of a new co-operative agreement with a provincial professional association. On January 1st the Association of Professional Engineers of Manitoba and the Winnipeg Branch of the Institute started on the new regime. From that date henceforth all meetings will be joint meetings of both organizations and fees of both will be collected in one payment by the Association from all joint members. Also both organizations will be managed by the one joint management committee.

This makes the sixth provincial group with whom the Institute has a co-operative agreement the others being Nova Scotia, New Brunswick, Quebec, Saskatchewan and Alberta.

Membership

The total of membership (14,659) again shows an increase but it is noticeable, that it is less than for the previous year. The difference has been brought about by the reduction in the number of Students which of course corresponds with the reduction of student enrolment at the universities.

It is encouraging to note that the increase in Members and Juniors is substantially higher than in previous years. In 1950 the gain in Members was 253 whereas in 1951 it was 376 an increase of fifty per cent. For Juniors the increase in 1950 was 1,182 and in 1951 it was 1,430 or approximately 20% better. During the year 1,054 new names were added to the rolls.

Roll of the Institute

The membership of all classifications now totals 14,659 which again is a record. New names added for the year 1951 amounted to 1,054, but deaths, resignations and removals reduced the net figure to a gain of 342.

During the year 1,018 candidates were elected to various grades of membership. These were classified as follows: Members 278, Juniors 129, Students 646, Affiliates 1. The elections for the previous year totalled 1,989. Thirty-six reinstatements were effected. Life Membership was conferred on 37 members under the revised by-law 26.

Transfers from one grade to another were as follows: Junior to Member 263, Student to Member 15, Student to Junior 1,891, a total of 2,169.

Removals from the Roll

There have been removed from the roll during the year for non-payment of fees and by resignation, Members 113, Juniors 305, Students 202, Affiliates 2, a total of 622.

Deceased Members

During the year 1951 the deaths of 73 members of the Institute have been reported as follows:

Members

Anderson, William
Angerman, Jaroslaw Kazimierz
Angus, William Forrest
Bakhmeteff, Boris A.
Ballantyne, Thomas B.
Bell, Robert Clifford
Bonnycastle, William Robinson
Bucke, Harold Langmuir
Burbank, Jerome Douglas
Callaghan, John
Carruthers, V. Hallam

Carswell, David Ballantyne
Colpitts, Walter Wm.
Connell, Charles Herbert Newton
Conway, George R. G.
Cowan, Edgar Clarence
Crowell, Seth W.
Dawson, William John Steele
Delaute, Frederick J.
Dickson, Wallace
Dixon, Leon Snell
Duncan, John Martin
Dunn, Guy C.
Dyer, John Henry
Ferguson, George Hendry
Fraser, Daniel Macfarlane
Gordon, John Abraham
Haight, Harry Vercoe
Hendry, Murray Calder
Jacques, Alfred George
Jenssen, Lawrence Nicholas
Jewett, Frederick Coburn
Johnston, Clifford Milton
Lee, Frank
Leman, Beaudry
Mattice, Ernest Stuart
Mitchell, Wallace Murray
Moodie, Kenneth
Moore, Joseph Harry
Moore, Rowland Chapman
MacCrimmon, Duncan Daniel
McCubbin, George Albert
McDonald, Floyd Robert
MacKay, Ernest George
McMurtry, Lawrence Carleton
Old, Frank John Archbold
O'Sullivan, John Joseph
Parham, John Bright
Patterson, Wilfred Ernest
Rutledge, Michael Joseph
Ryder, Frederick James
Saunders, Max Gordon
Sise, Paul Fleetford
Smith, Robert Francis Alexander
Sprenger, A. Reginald
Stamford, William Leonard
Stewart, John Robertson
Stewart, Murray Alexander
Stott, Joseph Duncan
Thrupp, Edgar Charles
Wardle, Edward B.
Watson, Hugh Munroe
Wheaton, Lewis H.
Whittier, Charles Comfort
Wilford, Frederick R.

JUNIORS

Bazett, Donald John
Cutler, Homer George
Lloyd, Wm. Ernest
Smith, Frank Wilfred
Snelling, Clive Anthony Gray

STUDENTS

Hayes, Allan Kenneth
Hayes, Harold Muir
Pollin, William Blackwood

TOTAL MEMBERSHIP

The membership of the Institute as at December 31st, 1951, totals 14,659. The corresponding number in 1950 was 14,317.

	1950	1951
Honorary Members..	20	23
Members	5,663	6,039
Juniors	3,740	5,170
Students	4,818	3,352
Affiliates	76	75
	14,317	14,659

Respectfully submitted on behalf of the Council.

IRA P. MACNAB, M.E.I.C.,
President

L. AUSTIN WRIGHT, M.E.I.C.,
General Secretary

●

Legislation Committee

Up to 31st December, 1951, two points of legislation were submitted to this committee for discussion and recommendations to Council:

A. Is it necessary to amend the by-laws to permit the Lower St. Lawrence Branch to consider all its members as being resident members instead of both resident and non-resident?

B. What amendment is required to the by-laws to allow Council to set the date and place of the annual meeting to coincide with the already agreed date and place of the annual meeting instead of going through the existing formality of having a "mock" meeting in January (as imposed by the existing by-laws) and to adjourn to the date and place of the actual general meeting already agreed to.
(See minutes 8097, 8098 and 8099 of meeting of Council of November 10, 1951.)

These points have been submitted to the Institute's solicitor and a preliminary report has been received.

Recommendations of this committee will be submitted to the next meeting of Council.

BRIGADIER JEAN P. CARRIERE, M.E.I.C.,
Chairman

●

Committee on Employment Conditions

As chairman of the above mentioned Committee for the Institute, I wish to report no specific activities for the past year. It appears that the present employment situation in Canada and abroad does not warrant the intervention of the Institute in any individual case that may develop.

As for the last few years, this Committee has not been called for any active work.

G. N. MARTIN, M.E.I.C.,
Chairman

●

Employment Service

Recently as a member of The Institute was passing an exit of the Central Station on Dorchester Street, a young man with an earnest look approached him and asked in a marked English accent, "Can you tell me where Mansfield Street is?" The engineer pointed it out and without hesitation added, "and if you follow it up about two and a half blocks you'll come to the Engineering Institute". The young man replied in mild surprise, "Why, that's exactly where I am going. Thanks so much."

Like many other applicants for engineering jobs, these arrivals from the United Kingdom and Europe, make a straight line for the Engineering Institute the moment they step from the boat or train. Frequently it is their first and only known point of contact in this country. During 1951, the majority of the interviews made by the Employment Service were with British and European applicants.

There are good reasons for the increasing number of engineers arriving from distant parts. The demands of Canadian industry, which has been expanding rapidly, are much greater than the supply of native-born engineers. Much attention has been given publicly by leaders of government and industry to the shortage of engineers. And the universities say that the next two graduating classes will provide even fewer engineers than before, making the shortage still more acute.

Various things have caused this decline, but this department is concerned more with the effect than the cause. Many Canadian companies have looked to The Institute to provide a steady supply of candidates, and new industries are seeking similar assistance. As a result many of the openings are being filled by engineers from outside Canada. In doing so, The Employment Service has not forgotten that the Canadian engineer is its first concern. Where a Canadian engineer's qualifications meet the requirements of a particular job, it is his name that is submitted to the employer. But with the present condition of an abundance of jobs and a shortage of applicants, it is frequently necessary to suggest the name of new Canadians.

Owing to the wide range of skills and experience, and the diversity of engineering jobs now opening up, not all applicants can be matched to jobs immediately. Many vacancies, calling for special requirements are still being listed. At the end of the year, there were still a large number of positions waiting to be filled.

In 1951 a total of 170 known placements were made and 450 jobs were listed. The most active period was from June to December. The normal slackening-off is now being experienced until the Spring brings back brisk demand again.

As the year ended some difficulty was experienced in placing many of the new arrivals in Canada. Some firms have set up certain quotas for foreign-born engineers, and these have now been reached, or for security reasons it is necessary to hire only Canadian or British subjects. Other organizations are still open to suggestion, but their requirements are frequently not within the experience of the applicants.

Many excellent placements of British engineers were made. A few, on the other hand, have proved either overcautious or hasty. There are several letters of application on file from engineers in the United Kingdom who seek a guarantee of a job before leaving their homeland. Now and then, a firm will offer such a guarantee, but most employers naturally prefer to interview the candidate in person, and the Employment Service can only provide its full facilities and assistance if the person is readily available to provide and obtain information by discussion. Other arrivals, of course, have simply taken a chance and left Britain in the hope that an unannounced visit to the Institute will bring results. It may well do, but in order that the Employment Service can thoroughly explore the employment field with the applicant's qualifications in mind, it is certainly safer and much more helpful to write in advance for information.

With large projects, involving hundreds of millions of dollars, now underway in Canada, there has been a great demand for construction engineers — mainly for young and hardy men who enjoy outdoor life and can move freely about the country. Another trend towards the experienced senior engineer was noticed in some industries, which are expanding and need the seasoned skill of the older man. In all branches,

there is great difficulty in finding junior replacements.

A tremendous amount of correspondence passed over the desk during 1951. Among them were acknowledgments from individuals and firms for services rendered. It is a pleasure to receive these letters and for practical reasons it is helpful, since they tell when the jobs have been filled, make possible the closing of files and concentration on others yet to be completed.

The Employment Bulletin, now in its fifth year of publication, is being circulated among more readers and further afield than ever before. During the year, 1,400 copies a month were distributed on the average, and a considerable number of these are being sent to the United Kingdom. It is becoming increasingly useful as a medium of information.

(Miss) A. Summers,
Employment Service

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Publication Committee

During the year, 181,045 copies of *The Engineering Journal*—an average of 15,087 per month—were printed. This is an all-time high and is by far the largest printing of any Canadian engineering publication. A total of 807 pages of technical and news material was printed.

Despite the high pressure under which engineers are working many excellent papers were received for publication and the committee extends the thanks of the Institute to the contributors and to branch secretaries and correspondents, for their valuable contributions. Thanks are extended too, to the editorial staff of the *Journal* for their outstanding work.

The advertising revenue during the year exceeded the forecast. Financially 1951 has been the best year in the history of the *Journal* and as a result of the improvement in the financial status of the publication the committee has recommended to council the employment of a full-time editor. The need for an editor has been apparent to the various members of the Publication Committee for many years but financial circumstances did not permit the additional expense.

During the year the committee suffered a severe loss when Floyd R. McDonald, M.E.I.C., passed away. Mr. McDonald was one of the hardest working members on the committee and his advice and untiring efforts were of the greatest value. Mr. McDonald's place on the committee was taken by W. D. Laird, M.E.I.C., formerly assistant general secretary of the Institute and now sales manager of the Diesel department, Consolidated Engines and Machinery Company Limited.

Seven meetings of the committee were held during the year, all well attended by members and Headquarters staff.

Many letters of commendation with regard to the editorial content of the *Journal* have been received and this leads the committee to believe that the membership favours the present form of the publication. Every effort is being made to so arrange the technical papers that they will be of interest to the majority of the members.

During the year three "separate" technical papers were published and made available to members. These have been designated as Technical Papers Nos. 3, 4 and 5. Technical Paper No. 3 "Air Entrainment by Water in Steep Open Channels" is by Melville S. Priest of the School of Civil Engineering, Cornell University. Paper No. 4 is "Graphical Solutions of Partial Differential Equations with Engineering Applications". The author is F. M. Wood, M.E.I.C., of Queen's University. Paper No. 5—"Economy in Rigid Frames" was written by T. A. Monti, M.E.I.C., District Engineer, Canadian Institute of Steel Construction, Montreal, Que. Publication of these papers was made possible by the generosity of the authors, who contributed the papers without charge to the Institute. They are being made available to members at nominal charges.

During the year the publication manager visited Britain to contact potential advertisers. Other trips were made by him to many parts of Canada and the United States. The Publication Manager has engaged the services of an advertising representative in Great Britain and representatives of the advertising department are also located in Toronto and Vancouver.

In the 13th Annual Editorial Achievement Competition conducted by "Industrial Marketing — a magazine which serves industrial publishers in the United States and Canada—the *Journal* was awarded first place for the "Best Single Article Among Class, Professional and Institutional Publications". Among the 600 entries from the United States and Canada, the panel of 24 judges selected the *Journal* as the only Canadian publication to receive an award. The paper which achieved this important recognition was "Design Development of the Avro Jet Liner" by J. C. Floyd of A. V. Roe, Canada, Ltd. The paper appeared in the *Journal* for January, 1950. The plaque now hangs in the main entrance of Institute headquarters. The committee extends congratulations to Mr. Floyd on bringing such distinction to Canada. This is the third award for the *Journal*.

Publications costs are showing a steady increase—and this fact combined with the rising circulation of the *Journal* will necessitate higher expenditures during 1952. The average gross cost of production during 1951 was 61.5 cents per copy or $7.38 per subscriber for the year. In an effort to assist advertisers in budgeting for 1952 the Publication Committee has decided to accept the recommendations of the Publication Manager not to increase the advertising rates next year. However, if it is found that actual costs exceed anticipated costs by any substantial margin, arrangements will have to be made for an increase in advertising rates to become effective at the beginning of 1953.

I. R. Tait, M.E.I.C.,
Chairman

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Membership Committee

The increase in membership of the Institute has been largely through recruitment in the Universities. Some increase has come about as the result of the formation of new Branches in communities previously not so served. The field secretary has done a valuable service in interviewing the engineers in such communities and expediting the formation of new Branches.

The importance of resident membership in maintaining a high ratio of E.I.C. members to the total engineering population cannot be overestimated. It is important in such communities to maintain contact with all eligible non-members so that some are regularly joining the Institute. As long as the branches keep growing conditions are healthy. The Committee urges that the branch executives give sustained support to their membership committee in bringing new members into the Institute.

H. R. Sills, M.E.I.C.,
Chairman

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Board of Examiners

During the year 1951 Council referred to the Board of Examiners fifteen applications for admission as Member with Examination, two applications as Junior with Examination, and three applications for transfers from Junior to Member.

Six of the Member applications and one transfer from Junior to Member have been dealt with and as all were successful in satisfying the Board with reference to their educational qualifications, their acceptance as Members was recommended to Council. The remaining applications are still in process and will be reported on when the Board has completed its findings.

C. A. Robb, M.E.I.C.,
Chairman

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Committee on Professional Interests

During the year contact has been maintained with the various branches by visits of the senior officers of The Institute. These visits have been welcomed by the branches and much enjoyed by the officers concerned and have indicated the effectiveness of the Field Secretary's services which are being carried out so satisfactorily by Colonel L. F. Grant.

With the inauguration of four new branches, namely, Rimouski, Que., Sherbrooke, Que., Fredericton, N.B. and Charlottetown, P.E.I., this year, the number has now reached the large total of thirty-seven branches. We particularly welcomed the inauguration of the Charlottetown Branch in that all ten provinces are now represented in the Institute family. This large number of branches, scattered from coast to coast, would indicate that serious consideration must be given to having more than one field secretary to enable adequate coverage.

It is noted with satisfaction that arrangements are now being made for the 1952 Joint Professional Maritime Meeting to be held in St. Andrews, N.B., in September and readers of this report are reminded that visitors from branches outside the Maritimes are particularly welcome.

The practice for vice-presidents to pay official visits to each of the branches in their zone has been continued and appears to be very effective. The maintenance of this practice is very important, particularly because the time is coming shortly, if it is not already here, when it is going to be impossible for the President to visit all branches as well as the eleven engineering student bodies.

No controversial items of moment

have been raised during the year to cause action to be taken by this Committee.

I. R. Tait, M.E.I.C.,
Chairman

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Library and House Committee

This committee held two meetings in the latter part of the year 1951.

The addition of new oil burner equipment for the heating system was made to the third furnace in the headquarters building. The equipment is operating satisfactorily.

Recommendations and approval were made for the replacement of the convector type radiators in the Records Office by means of new units of the conventional radiator design. The installation was completed during the Christmas holidays.

Studies were made re the possibility of renting outside space in nearby buildings, for providing space to accommodate the Publication Department. The results were unsatisfactory and therefore discontinued. As an alternative, studies are now being made for the possibility of constructing a balcony at the rear of the west end of the main lecture hall, for the purpose of providing the additional office space required. Further studies are being made as to the necessity of replacing portions of the flashing on the roof of the building.

The attention of the members is again drawn to the Library Film Service. The Institute membership in the Canadian Film Institute gives the members access to all film information obtainable from Ottawa and enquiries are invited.

R. N. Coke, M.E.I.C.,
Chairman

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Library Report

The year 1951 in the library marks the start of a working **catalogue** according to the Universal Decimal System, of the newer books in the collection. This was the system agreed upon at the Conference of Commonwealth Engineering Institutions held in London in 1946. The library now has five working active catalogue drawers of books dated 1950 and 1951, which have been completely classified and catalogued, and the work is progressing with the enthusiasm of all concerned. Since last January, 272 volumes have been completely processed, involving the typing, sorting and filing of 1,301 cards. As this catalogue expands, so will service to the members increase in speed and efficiency.

It is possible that members are not all aware of **library services,** which are being stressed in this report. They have free access to a library of over 14,000 books, magazines, and technical bulletins and pamphlets. Permanent active borrowers, that is, members who leave a permanent deposit with us of at least five dollars, total 508. Some hundreds of others, mostly student members, and young engineers on limited budgets, use the temporary deposit system, which involves the withdrawal of this deposit each time they return borrowed items.

Inter library loans. There are three fully trained professional librarians at headquarters, who can procure any book from any library in the Montreal area, or farther a-field if it cannot be located here. These inter-library loans totalled 312 during 1951.

Photostats. 146 photostat print pages have been ordered by members during the past 12 months. Besides having photostats done locally, inter-library arrangements with the National Research Council in Ottawa for speedy and reasonably priced prints from anything in their collection, is an additional service.

Book and subscription ordering. The library functions as a retail agent for any and all book ordering by E.I.C. members. Publishing and book regulations of course prohibit anything but the regular retail charges for such orders, but the library does benefit from all orders placed in this way. The obvious advantage to the members is, that by placing orders through the library they avoid all problems of customs, import regulations and purchase of foreign exchange, which are at times particularly complicated with technical publications.

Professional magazines and periodical publications of affiliated societies, however, may be purchased at reduced rates (which are usually the same as those paid by their own members) if orders are placed through the library. Such orders totalled 404 during the past twelve months.

Reference service. However far away you may live the reference department is at your service. If you live in Montreal, a librarian will direct and help you in your search for material, and a telephone call will answer straight enquiries as to holdings, available books, etc.

For members outside of Montreal, bibliographies and source material on any technical or related subject, may be prepared. If consultation of items from these bibliographies is desired, they are either mailed out, or, if more convenient, arrangements are made for them to be borrowed by the member from a library closer at hand. Pages of such source material during the past year totalled forty-six, covering thirty-seven different subjects. Enquiries covering the forementioned involved 4,194 telephone calls, 2,129 in person during the day time hours, 191 during the evening hours, and 2,060 by mail, making a complete count of 8,514.

Films. At the present time the library has 12 films in its collection, and their titles and a short account of each, except where the film is self explanatory, are as follows:

Films available from the Engineering Institute of Canada Library:

Title: All Star Castings.

Sponsored by Lloyds foundry. London, Big Six Film Unit, 1948. 1 reel, 20 min., B. & w., sound, 16mm. (Copy No. 10.)

Shows the manufacture of light weight iron castings at a Derbyshire works, and the application of these as parts to agricultural tractors, to lifting and stacking trucks and for motor cars of every kind.

Title: Art of Drilling.

Sponsored by Victor Products. London, Edward Cook, 1948. 1 reel, 684 ft., B. & w., sound, 19 min., 16mm. (Copy No. 28.)

Story of drilling stone and coal with electric and compressed air driven rotary drills, and how to double and even quadruple performance by attention to time study allocation and co-ordination of task.

Title: At Foot of Pentland Hills.

Sponsored by Hugh Wood & Co., Ltd. London, Edward Cook and Big Six Film Unit, 1948. 1 reel, 790 ft., 22 min., B. & w., sound, 16 mm. (Copy No. 22.)

Story of the manufacturing and assembly of a chain conveyor and depicting its actual use underground at a large colliery in Scotland.

Title: Benarty.

London, Edward Cook, and Big Six Film Unit, 1948. 1 reel, 650 ft., 18 min., B. & w., sound, 16 mm. (Copy No. 18.)

Shows the erection underground in a Scottish colliery of a retarder chain conveyor on an incline of 1 in 2, and the manner in which coal is safely conveyed under these conditions.

Title: Britain Must Choose.

London, Big Six Film Unit, 1948. 1 reel, 20 min., B. & w., sound, 16mm. (Copy No. 15.)

The story of pneumatic mining picks, showing these in use on coal faces from two feet six inches in height to six feet in height.

Title: Faster Than Sound.

British Information Services. 1 reel, 20 min., silent, 16 mm.

The story of research on the supersonic rocket.

Title: Fido — Fog Dispersion on Airport Runways.

Eastman, 1947. 1 reel, 20 min., 16mm., commentary to accompany film.

Title: Flawless and British.

Sponsored by Lloyds Foundry. London, Big Six Film Unit, 1948. 1 reel, 685 ft., 19 min., B. & w., sound, 16mm. (Copy No. 36.)

Showing the manufacture in a Staffordshire steel works of heavy steel castings for almost every type of heavy capital equipment.

Title: Flying Skyscraper.

United Kingdom Information Office, Ottawa. 1 reel, 20 min., silent, 16mm.

The Bristol Brabazon aircraft.

Title: G. B. 40.

London, Big Six Film Unit, 1948. 1 reel, 20 min., B. & w., sound, 16mm. (Copy No. 18.)

A training film for miners which shows how a top and bottom belt conveyer and its drive heads have to be assembled, and giving instructions about their maintenance underground.

Title: Harbour Goes to France (Mulberry).

National Film Board, Ottawa, 1946. 1 reel, sound, 16mm., B. & w., 20 min. (Copy No. 104.)

Title: Jet Getaway.

British Information Services. 1 reel, 20 min., silent, 16mm.

Shows the operation of an ejector seat for jet aircraft.

Title: Pluto (Pipes Under the Ocean).

Eastman, 1947. 1 reel, 16mm., colour, 20 min., commentary to accompany film.

Title: Royal Canadian Engineers in Action Overseas.

Produced by Canadian Army Film Unit, 1942-3. 1 reel, B. & w., 16mm., commentary to be read.

Title: Tacoma Bridge.

Eastman. 2 reels. B. & w., silent, 16mm.

Conditions governing the circulation of these films are the same as those of other library holdings. In addition to these reels on hand, the Institute is a member of the Canadian Film Institute in Ottawa. This membership entitles all members to access through the library, to all film information and films obtainable from Ottawa.

After office hours. During the winter months, the library is open each week day until 6 p.m., and until 8 p.m. on Thursday evenings, this latter during the period of the Montreal branch meetings. Also, except during the summer months, it is open Saturday mornings from 9 until 12.

Your enquiries are invited.

EMILY KEELEY,
Chief Librarian.

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Finance Committee

Although a study of the statements of "Revenue and Expenditure" and "Assets and Liabilities" together with the Treasurer's Report for the year, published concurrently with this committee's report, shows in detail a picture of the Institute's financial condition, there are important features not revealed therein, though in a general way known to the membership. Perhaps the most important is the impressive and rapid growth in revenues accompanied by a similar and unavoidable increase in expenditures particularly those connected with the printing of the Journal. Over the period since 1942 the revenue has increased from $63,800.00 to a figure exceeding $305,000.00 shown for 1951.

While this increase in revenue has in that same period been accompanied by, and is indeed largely a result of, an increase in membership from 5,652 to a figure of approximately 15,000, the insistent demand by the members for increased services has caused a growth in expenditures in every department that has precluded any possibility of showing anything more in these years than a small surplus.

As in the past other Institute committees reporting this year are requiring

Comparative Statement of Revenue and Expenditure

For the Year Ended December 31, 1951

REVENUE

	1951	1950
MEMBERSHIP FEES:		
Arrears	$ 3,277.60	$ 3,467.36
Current*	116,572.47	102,126.86
Advance	470.20	1,354.63
Entrance	3,468.00	2,771.20
Voluntary assessment	5,049.62	
	$128,837.89	$109,720.05
PUBLICATIONS:		
Journal sales	$ 109.50	$ 60.25
Journal advertising	174,974.51	127,599.56
	$175,084.01	$127,659.81
INCOME FROM INVESTMENTS	$ 1,166.35	$ 1,190.16
REFUND OF HALL EXPENSE	565.00	1,000.00
SUNDRY REVENUE AND PROFIT OR (LOSS) ON SALE OF SECURITIES	(576.42)	603.15
	$305,076.83	$240,173.17

* Membership fees include journal subscription.

EXPENDITURE

	1951	1950
BUILDING EXPENSE:		
Property and water taxes	$ 1,529.31	$ 1,385.82
Fuel	865.94	726.27
Insurance	654.14	463.36
Light, gas and power	810.44	826.73
Caretakers wages and services	1,532.42	1,488.00
House expense and repairs	2,726.05	2,570.23
	$ 8,118.30	$ 7,460.41
PUBLICATIONS:		
Salaries	$ 11,699.90	$ 11,287.84
Printing and sundry expense	114,475.79	83,893.82
Advertising and management	43,391.40	31,695.51
	$169,567.09	$126,877.17
OFFICE EXPENSE:		
Salaries	$ 49,141.34	$ 46,243.00
Telegrams, postage and excise	3,461.47	2,596.08
Telephones	1,703.97	1,108.73
Office supplies and stationery	10,488.51	6,900.67
Audit and legal fees	1,065.05	685.20
Messenger and express	289.85	148.40
Miscellaneous expense	2,448.44	1,704.82
Depreciation — furniture and fixtures	986.45	958.52
	$ 69,585.08	$ 60,345.42
GENERAL EXPENSE:		
Annual and professional meetings	.....	.....
Students' Conference	$ 1,097.85	.....
Meetings of Council	880.32	$ 1,572.46
Travelling	7,689.45	4,806.85
Branch stationery	239.38	316.34
Institute prizes	371.89	455.60
Library salary and expense	9,140.27	9,987.01
Interest, discount and exchange	365.02	214.37
Committee expenses	293.63	400.20
Cost of membership in other societies	2,211.02	1,856.50
Sundry expense	859.44	736.26
Pension plan and reserve	7,665.72	745.27
Membership directory	480.00	4,269.90
	$ 31,293.99	$ 25,360.76
REBATES TO BRANCHES	$ 21,161.17	$ 16,670.81
TOTAL EXPENDITURE	$299,725.63	$236,714.57
TRANSFERRED TO BUILDING FUND	5,000.00	3,000.00
SURPLUS FOR YEAR	351.20	458.60
	$305,076.83	$240,173.17

funds for increased services to the members. Despite the increased business indicated above we are still carrying on with the same accommodation as that of ten years ago and more (except for the appropriation of the reading room previously reported)—the Journal badly needs staff assistance, our field service requires extension, our reserves require augmenting, etc., all of which poses a serious problem to this committee. It would appear that the cost of services required for members has outgrown our revenue and, while it has been a matter of satisfaction that over the years our increase in fees has been modest in comparison with that in other organizations, it is felt that some action in this respect must soon be taken. This matter has already been actively discussed by this committee and with some of the branches by your chairman in company with the president.

The recommendation of your previous committee concerning reserves as well as Council's instruction concerning investments has been carried out.

It can be reported with some satisfaction that the Institute's financial position has improved measurably during the year due in great part to the prudent direction of our predecessor committee under the chairmanship of R. E. Heartz, M.E.I.C., coupled with the capable administration of funds by our general secretary and staff, whose duties were carried out in a manner deserving of the great appreciation which this committee is herein pleased to express.

Submitted on behalf of the committee.

J. B. Stirling, M.E.I.C.,
Chairman

Treasurer's Report

The current high level of employment in the engineering profession is reflected in the audited financial statements of the Institute for the year ended December 31st, 1951, appearing below. In this connection the importance of following a conservative financial policy against the day when this will no longer be the situation cannot be over-stressed.

Income from membership fees totalled $128,837.89, an increase of $19,117.84, or some 17% over 1950. This increase includes $5,049.62 from a voluntary assessment which was initiated in 1951.

Revenue from publications was $175,084.01, as compared with $127,659.81 for the year 1951, an increase of 37%, and expenses were $169,567.09, as against $126,877.17 for the previous year, an increase of 34%. Gross profit for the year

Comparative Statement of Assets and Liabilities

As of December 31, 1951

ASSETS

		1951	1950
Current Assets:			
Cash on hand and in bank		$ 27,624.62	$ 5,376.77
Accounts receivable — less reserve		20,538.65	13,972.88
Arrears of fees — estimated		3,500.00	3,500.00
		$ 51,663.27	$ 22,849.65
Investments at Cost:			
Property of Engineering Institute of Canada	$38,179.62		
Property of special funds account (approximate market value $56,915.00)	19,213.93	57,393.55	56,728.75
Sundry Advances		250.00	116.50
Deposit with Postmaster		400.00	400.00
Prepaid Insurance		485.00	756.00
Gold Medal		45.00	45.00
Library — at cost less depreciation		1,448.13	1,448.13
Furniture and Fixtures — at cost less depreciation		8,878.07	8,626.68
Land and Building—assessed valuation		36,000.00	36,000.00
		$156,563.02	$126,970.71

LIABILITIES

		1951	1950
Current Liabilities:			
Accounts payable		$ 14,613.37	$ 9,803.53
		$ 14,613.37	$ 9,803.53
Special Funds:			
As per statement attached		19,213.93	18,687.31
Reserves:			
Building fund		25,000.00	20,000.00
Building maintenance		2,000.00	2,000.00
Contingent reserve		20,000.00	5,000.00
Pension fund reserve		10,366.50	5,366.50
Technical publications fund		.....	1,095.35
Surplus Account:			
Balance as of December 31, 1950	$65,018.02		
Add: excess of revenue over expenditure for year as per statement attached	351.20	65,369.22	65,018.02
		$156,563.02	$126,970.71

AUDITORS' CERTIFICATE

We have audited the books and vouchers of The Engineering Institute of Canada for the year ended December 31, 1951, and have received all the information we required. We have verified the cash in banks and the investment securities and the revenue therefrom. In our opinion, the statement of assets and liabilities and statement of revenue and expenditure for 1951, as attached, are properly drawn up so as to exhibit a true and correct view of the Institute's affairs as of December 31, 1951, and of its operations for the year ended that date, according to the best of our information and the explanations given to us and as shown by the books of the Institute.

PEAT, MARWICK, MITCHELL & CO.
Chartered Accountants.

Montreal, February 5, 1952.

was $5,516.92, but it should be noted that as in previous years no charge has been made for various items such as office rent, mailing services, and general overhead.

The surplus for the year after transferring $5,000.00 to the building fund amounted to $351.20, as compared with $458.60 in 1950.

The decision of Council to provide a hedge against inflation by investing a portion of its funds in the common stocks of selected companies engaged in basic industries was put into effect. These stocks purchased early in the year at a cost of $12,382.30 had a market value as at January 28th, 1952, of $15,379.38.

G. A. GAHERTY, M.E.I.C.,
Treasurer

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Papers Committee

In reviewing the work of the Papers Committee for many years past, the members of the 1951 Committee realized, and in this they concur with the reports of the past chairmen, that the functions of the papers committee, as defined in the by-laws and under the present operating conditions, cannot possibly be performed by individual members. Endeavouring to supply speakers, papers and films to a large number of branches in such a wide territory as ours is a task which would normally require the help of the regular Headquarters staff. In fact, it is believed that in the past no definite action has been taken by the successive Papers Committee in supplying such services to the Institute branches.

However, the members of the Papers Committee are fully convinced that the success of the Institute as a whole is, shall we say, directly proportional to the successful operation of its branches. Furthermore, no branch will be qualified as successful unless it is active. This implies the importance of Headquarters and of the Council doing their utmost to help keep the Institute branches in full operation and one of the best ways to attain this purpose is to supply them with speakers, papers and films whenever necessary. It is a well recognized fact that Canadian engineers look to their institutions for what they can get out of them in the form of technical information and social pleasure. Those who are members of, shall we say, an inactive branch are likely to sever their connections with the Institute and try to get these benefits elsewhere. Servicing our branches is therefore servicing our own members thereby increasing the efficiency of our national engineering body.

A very elaborate investigation was made by the Papers Committee in 1949. Contact has been made with all the Institute branches in order to define their need of help from Headquarters in organizing and implementing their program of meetings. It is interesting to note that the services of the Papers Committee are by no means required generally. It is obvious that the bulk of the work of organizing meetings has to be done locally, but much good would be derived if we could achieve closer co-operation between the branches in this matter. The members of the committee firmly believe that such co-operation may be achieved or, at least, encouraged if the Papers Committee,

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STATEMENT OF SPECIAL FUNDS

As of December 31, 1951

LEONARD MEDAL FUND:		
Balance as of December 31, 1950	$ 595.84	
Add: 3% interest	17.22	
	$ 613.06	
Less: Medal	21.00	$ 592.06
PLUMMER MEDAL FUND:		
Balance as of December 31, 1950	$ 808.63	
Add: 3% interest	24.24	832.87
PAST PRESIDENT'S PRIZE FUND:		
Balance as of December 31, 1950	$8,754.68	
Add: 3% interest	262.62	9,017.30
DUGGAN MEDAL FUND:		
Balance as of December 31, 1950	$2,996.29	
Add: 3% interest	90.00	3,086.29
JULIAN C. SMITH MEMORIAL FUND:		
Balance as of December 31, 1950	$ 985.46	
Add: 3% interest	29.19	
	$1,014.65	
Less: Medal	12.00	1,002.65
FUND IN AID OF MEMBERS' FAMILIES:		
Balance as of December 31, 1950	$4,027.64	
Add: 3% interest	120.81	4,148.45
PIONEERS OF SCIENCE PRIZE FUND:		
Balance as of December 31, 1950	$ 245.74	
Add: 3% interest	7.35	253.09
LIFE MEMBERS DONATION FUND:		
Balance as of December 31, 1950	$ 273.03	
Add: 3% interest	8.19	281.22
		$19,213.93

THE HARRY F. BENNETT EDUCATIONAL FUND OF THE ENGINEERING INSTITUTE OF CANADA

STATEMENT OF RECEIPTS AND DISBURSEMENTS

For the year ended December 31, 1951

Balance as of December 31, 1950		$23,481.09
Donations		3,426.50
Interest on loans repaid		22.38
Interest on investments		510.00
		$27,439.97
DEDUCT:		
Sundry bank charges	$ 2.41	
Sundry printing etc.	20.00	
		22.41
BALANCE AS OF DECEMBER 31, 1951		$27,417.56
Investments at cost (approximate market value — $15,750.00)	$16,920.00	
Loans outstanding (see list)	8,225.00	
Cash at bank	2,272.56	
		$27,417.56

INVESTMENTS AT COST:

$10,000.00	Dominion of Canada Bonds 3% Sept. 1, 1966	$10,037.50
7,000.00	Province of Ontario Bonds 3% Apr. 15, 1965	6,882.50
		$16,920.00

AUDITORS' CERTIFICATE

We have audited the books of The Harry F. Bennett Educational Fund of The Engineering Institute of Canada for the year ended December 31, 1951, and have obtained all the information and explanations we have required. The accounts record interest received on fully repaid loans only, no charge having been made for accrued interest on outstanding loans. In our opinion, the above statement of receipts and disbursements is properly drawn up so as to exhibit a true and correct view of the affairs of the Fund as of December 31, 1951, and for the year ended that date, according to the best of our information and the explanations given to us and as shown by the books of the Fund.

PEAT, MARWICK, MITCHELL & CO.,
Chartered Accountants.

MONTREAL, JANUARY 15, 1952.

with the help of Headquarters staff, were given the tools to do the job. By this we mean that Headquarters must first of all know exactly what is going on in any one branch that may be of use to another branch. We understand that notices of meetings are sent from all branches to Headquarters, but this is not considered sufficient information for the Papers Committee.

We propose that all branches of the Institute report to Headquarters after each of their meetings and that this be done on a standard form similar to the one attached to our report. Headquarters would act in conjunction with the Papers Committee as a clearing house in disseminating information likely to be useful.

As an example, the Winnipeg branch might happen to have as their speaker one evening an engineer from the Maritimes. He had been invited to talk at Winnipeg due to his personal acquaintance with one of the officers of the branch, and took the opportunity of a business trip to stop at Winnipeg. The report of the Winnipeg branch shows that the meeting was excellent or outstanding. Headquarters and the Papers Committee, upon receipt of such a report, could forward the speaker's name and address with comments to some of the Maritime branches either at Moncton, Saint John, Fredericton or Charlottetown. In another case, the Toronto branch has had a paper by a very well known engineer from the States; he was travelling at the expense of his firm and does this quite extensively. This of course is made known through the Toronto Branch in their report to Headquarters. This speaker delivered a very good talk and his paper was illustrated with an outstanding technical film. It would be a straightforward matter for Headquarters and the Papers Committee to refer the name of the speaker and all relevant information appearing on the Toronto report to the Montreal branch for instance, who may then, at a future date, make use of this reference.

The members of the committee suggest that this proposal of a branch report be brought forward at the branch conference in Vancouver and, if it is agreed, that the Council should undertake to have the forms printed and distributed to all branches during the summer. This system could then be in operation in the fall of 1952.

Among the other points discussed by the Papers Committee this year, we feel that the following is worthy of being mentioned in our report.

It is a fact that our country is developing very rapidly; it has now attained the rank of an independent nation acting on its own and will become more and more a factor in international affairs. This has been rendered possible by the force of its sound economy, of its industrial production and by many other factors which have a strong effect on Canadian life. It is believed that too few Canadians realize the importance of their country and it is therefore proposed that one of the coming annual meetings carries the following theme: "Canada, an international force". The purpose of all the papers and of the activities of this annual meeting could be centred around this general thought and would deal with Canadian diplomacy, Canadian defence, Canadian industrial expansion, Canadian natural resources, Canadian trade. The role of Canada among the United Nations, the part Canada plays in the Commonwealth and so on. Each paper would bring forward within its field Canada's growing position among the nations of the world.

HENRI GAUDEFROY, M.E.I.C.,
Chairman

Admissions Committee

I am pleased to report as follows on the activities of the Admissions Committee for the year 1951.

The Committee held ten meetings previous to the Council Meetings and a total of one thousand four hundred and ninety-seven cases were reviewed, and are broken down as follows:

Applications for Admission ...	296
Applications for Transfer	210
Applications through Professional Associations:	
(a) Admissions	143
(b) Transfers	105
Student applications	691
Special cases	52

L. A. DUCHASTEL, M.E.I.C.,
Chairman

Nominating Committee

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Prairie Water Problems Committee

While your committee was not particularly active during the past year, two members of the Committee, namely Dr. T. H. Hogg and Mr. G. A. Gaherty, have been particularly active. Dr. Hogg was appointed Chairman, and Mr. Gaherty a member of a three man Royal Commission for the Federal Government on the South Saskatchewan River Project in the Province of Saskatchewan. Dr. Widstoe of Salt Lake City, Utah, U.S.A., a prominent authority on irrigation, is the third member of the Commission. Mr. D. W. Hays, another member of our committee, was appointed consulting engineer for the Royal Commission and Mr. B. T. Richardson, of Ottawa, was appointed secretary. This Commission has a very important task and we look forward with great interest for its report.

While the International Joint Commission has not made a report on the application of the United States for allotment of portions of the flow of the Belly and Waterton Rivers, considerable additional study and consideration has been done by the Commission. Its report is expected at an early date.

Calgary Power Limited completed the construction of the Spray project during the year 1951 which added 210,000 acre feet of storage in the Bow River basin and 90,000 h.p. to the company's power production.

During the year, considerable progress was made in the construction of the additional irrigation works for the enlargement of the St. Mary and Milk Rivers Development in Southern Alberta. An additional 8,000 acres was brought under irrigation in 1951. The plans for 1952, provide for completing the works to supply water for an additional 45,000 acres of land between Lethbridge and Medicine Hat.

Early in the year, the P.F.R.A. Branch of the Dominion Department of Agriculture took over the irrigation works and lands of the Canada Land and Irrigation Company and has launched an extensive construction programme to increase the area served by the Bow River Development from about 60,000 acres to over 200,000 acres. The programme includes some interesting engineering features besides the rehabilitation of farmers from drought areas.

Several members of our committee attended a meeting of the Western Canada Reclamation Association in Lethbridge in July. The business of the meeting consisted largely of developing plans for future activities of the Association.

We regret to report the death of one of the members of the Committee, namely G. N. Houston of Olds, Alberta. Mr. Houston was very interested in the work of the Committee and contributed considerable assistance.

P. M. SAUDER, M.E.I.C.,
Acting Chairman.

Canadian Chamber of Commerce

The following quotation from the 22nd Annual Report is a concise statement of the aims and objects of the Canadian Chamber of Commerce:

"A voluntary federation of over 700 Boards of Trade and Chambers of Commerce in all ten provinces, working together for National Welfare.

"Supported by 2,200 companies and 25 national trade and professional organizations associated with the business life of Canada.

"Directed by the membership through a 50-man Board of Directors and 150 committee men of experience and proven commercial success.

"It secures and presents an informed

opinion from organized business so as to obtain the proper consideration of national questions concerning the economic, financial, commercial, industrial and agricultural interests of Canada.

"Business individually is unable to do what business collectively can. The Chamber provides the medium for united action by business people."

Canadian business, during the past twelve months has been marked by a continued increase in the gross national product, vigorous capital expenditures and an unprecedented volume of export trade. A part of this expansion is due to the $5 billion three-year defence programme, effects of which are already creating problems which will be accentuated as defence production picks up.

This production for defence, superimposed on full normal demand would have added considerably to inflationary pressures. In an effort to counteract this, the federal government sharply increased taxes and placed restrictions on consumer credit. These credit restrictions undoubtedly acted as a brake on inflation. The effect of higher taxes, however, designed to siphon off surplus purchasing power, was not altogether what had been expected. The demand for higher wages prompted by the higher taxes appears to have added to the inflation so evident in the previous year. This has unfortunately created agitation for the futile panacea of price control.

In these days of the so-called cold war, when so much of our national effort must be diverted from normal peacetime pursuits to preparation for defence, with resulting high taxation and the threat of spiralling inflation, the fiscal policies of the Government require very careful consideration and study. The Chamber is in a unique position to advise on many of the problems that arise and to muster expert opinion which it can place at the service of the various government departments. It will continue to be an important factor in the promotion of co-operation and understanding between government and business.

J. A. McCrory, M.E.I.C.,
Representative of the Institute

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Canadian Standards Association

During 1951 the CSA has again been very busy in its principal channel of endeavour, the preparation and revision of useful standard specifications. Many new publications have been issued, many more are being printed for early issue and more again are under consideration or in process of production.

In the Civil Engineering Section "A", the CSA will be undertaking new tasks as the outcome of a joint meeting between its Sectional Committee on Building Materials and the National Building Code Technical Committee on Materials, a meeting to which your representative was invited in his capacity as Chairman of the CSA Sectional Committee on Steel Construction. Specifications on Asphalt and Coal Tar Products, Metal lath, Wood lath, Gypsum, etc., will be dealt with and revisions will be studied in the existing standards for Brick and Tile as wall material. Concrete construction will be benefited by new standards on Ready Mix methods and products, Concrete pre-cast units of various types and Cements, as well as by certain changes in the widely accepted A-23 on Reinforced Concrete Design and Practice. Pre-stressing will also be featured in the new studies on Concrete Poles.

In the Mechanical Section "B", Fire-fighting equipment has occupied a prominent place. Two new standards are ready to print and two more on Hose and Extinguishers are under active consideration. Identification of Pipe and Conduit Lines is another important associated subject being currently dealt with. In this same section, committees have been vigorously advancing the work of issuing standards on Drawing Office Practice, Limits and Fits, Threads, Screws, Small diameter rivets and so forth.

The Electrical Section "C" is continually expanding and some 22 projects have been under way during the year either for revisions or new developments. These cover such varied items as Transformers, Meters, Cables, Wire, Circuit Breakers, Pole-line Hardware, Safety equipment, Street lighting, and numerous branches and subdivisions of these headings.

Many of the separate Parts of the Canadian Electrical Code have been revised, modernized, expanded or augmented. Radio, Mining practice and other fields have provided work for the specification committees of this Section.

Under Section "G"—Ferrous metals—we find Stainless Steels as a subject of study and Forgings as a standard up for revision. Deformed Reinforcing Rods present one new field whilst the existing standards on all steel reinforcement are under review. New standards are being prepared for a number of small items such as metal fasteners, metal connectors, and containers, while galvanized iron and steel sheets also demand attention.

The Section on Timber, namely "O" has several committees actively engaged in developing standards for laminated and solid timber units for structural uses, for plywoods, shingles, cross-arms, pins, piles and the processes of wood preservation.

Under "S" the Section on Steel Construction, the special committee has just about completed the final draft of a new issue of the Specification for Highway Bridges, and a similar committee on Movable Bridges is busy on a study of the existing specification on this highly specialized subject to see whether modifications are required.

The Welding Section "W" is continuously active, and during the year has been concerned with Electrodes for Mild Steel, Alloy Steel, Stainless Steel, etc., while its committees are also studying the preparation of suitable standards for Resistance Welding, Gas-Welding, and the general question of safety devices for operators in these fields.

Notwithstanding this great activity, the CSA realizes that there is much more to be done, and in its capacity as a national but neutral body it is ready to undertake standardization of codes, practices and specifications wherever there is a demand or an opportunity to serve industry in Canada.

P. L. Pratley, M.E.I.C.,
E.I.C. Representative on the Main Committee.

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Coming Events:

Annual General and Professional Meeting Vancouver

May 7, 8, 9 - 1952

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Abstracts of Reports from Branches

Note—For Membership and Financial Statements see pages 118 and 119

Belleville Branch

There were eight general meetings of the Branch during the year, all of which have been reported in the *Journal*.

Outstanding speakers were sought, in a wide range of subjects, in view of the fact that Belleville is a new Branch and an attempt was being made to explore the field of interest.

There was a good attendance at all meetings throughout the season, with the exception of the combined meeting with the Peterborough Branch for the President's visit on November 7th. Unfortunately, the worst ice storm of the season made the roads impassable and only one member was able to represent Belleville at this meeting in Peterborough.

Since there is a majority of electrical members in the Branch, those meetings which dealt with electrical subjects had best attendance but, in addition, it was quite evident that general subjects on personnel relations and general scientific subjects met with general acceptance.

Border Cities Branch

Among the highlights of the Branch activities during the year were two presidential visits.

The first dinner dance of the Branch, held during the visit of President Macnab, proved highly successful.

A promising start was made in the organization of a Ladies Auxiliary, and an inaugural meeting was scheduled for early in the new year.

Calgary Branch

Nine general meetings were held during the year covering a variety of subjects. Petroleum engineering was represented by three papers, which covered gas deliverability, oil pipe line construction and petroleum products testing. Other subjects dealt with were forest and water conservation, weather forecasting, air conditioning and permafrost problems. The work of the city utilities engineers departments was discussed in a symposium by four staff members. There was also a film night during which films were shown of the construction of "Pluto", the cross channel pipe line, and of the manufacture of cement.

In addition to these general meetings there were three meetings of a special nature. In October, the members and their ladies were entertained at an informal dance and bridge party, and in May, fifty members travelled to Banff for a special meeting with members and friends of the Institute there. One of the highlights of the Banff trip was a golf match on the Banff Springs course prior to the dinner meeting. In October, a plant visit was held at Exshaw at the plant of the Canada Cement Company. The members were given the opportunity of watching the process of manufacture and were entertained at lunch by the Company.

The Branch continued its meetings throughout the winter season. These meetings attract about thirty members each Monday noon, and the lunch is followed by a short talk or film on engineering work.

Cape Breton Branch

The Cape Breton Branch has had another successful year. As usual a supper meeting was arranged once a month, except during the four summer months. Attendance at these meetings has been fairly good but a better turnout is possible. There has been an increase in the number of affiliate members. All the affiliates are closely allied with engineering and are welcome additions to the Branch.

Central British Columbia Branch

Six executive meetings and six general meetings were held during the year. In addition special meetings at Penticton, Kelowna and Kamloops were held to coincide with the visit of Field Secretary L. F. Grant. There was no meeting with the President of the Institute in 1951 this matter being deferred until the president's trip west in 1952 to attend the annual general meeting of the Institute at Vancouver in May.

There was noted an increase in membership in the Branch, also an increased attendance at general meetings which showed a growing interest in Branch affairs.

For the first time separate committees were set up this year to aid the executive in its work. A start was made on collecting information on student guidance and it is intended to set up a separate active committee to further this work next season.

The past season saw the inauguration of the joint meetings with the Central B.C. Branch of the B.C. Engineering Society. This cooperative effort has worked out very satisfactorily and to the mutual benefit of the two groups. Of five general meetings held at Vernon, at Kelowna, and at Penticton, three were joint meetings, and all included talks or films on engineering subjects.

Cornwall Branch

The year 1951 has been an active one for the Cornwall Branch. The program committee has arranged for a total of eleven events during the ten months available for meetings. Among these were June and September meetings which were successful experiments in reducing the length of the summer period of inactivity.

The year's activities included two film nights, three speaker meetings, two dinner-dance evenings, two smokers, and two plant tours. Average attendance at the eleven functions of the year was 36. Judging by attendance, the film nights were most popular with average attendance of 40. Speaker meetings came second in popularity with average attendance of 38. The dinner-dances drew an average of 27 members, the plant tours averaged 23, and the smokers 22.

On the whole, it is felt that attendance at meetings has improved considerably.

The highlight of the year's events for those fortunate enough to be able to attend was the tour in June to the National Research Council Laboratories in Ottawa. This was a very interesting experience.

During the year there were a total of nine branch executive meetings, and the average attendance at these was seven.

Eastern Townships Branch

The Branch inaugural meeting was held on November 9th and was attended by the president and officers of the Institute as well as several councillors and officers from neighbouring branches.

The first regular meeting of the Branch was held on December 7th. A representative from the Aluminum Company of Canada, Limited, was the guest speaker. He spoke on his company's recent developments in British Columbia, and showed a film on the subject. The meeting was followed by a buffet supper. The 48 persons attending included thirteen non-member invited guests.

Dr. J. A. Bois was invited to speak at the meeting scheduled for January 18, 1952. Succeeding meetings were tentatively planned as follows: for the March meeting, several members were asked to give 5-minute talks on their occupations. In May the annual meeting and election of officers will take place, and in June, Ladies' Night, will be the last meeting of the season.

Edmonton Branch

Papers were given at seven of the meetings of the Branch during 1951, and dealt with such subjects as: the Hay Lakes development of the Calgary Power Company; the Winnipeg flood; liquefied petroleum gases as alternative motor fuel; industrial gas turbines; oil refining; construction of the interprovincial pipe line; and town planning. A panel on civil defence took place at the April meeting.

The annual meeting and election of officers, in April, was novel in that reports were mailed to the membership in advance, and it was then necessary merely to move their adoption. The business meeting did not exceed one half hour, and was followed by a social evening. This method has been adopted as a more interesting wind-up for the years' activities.

The annual picnic was held in June, to which all members, their wives and families were invited.

Fredericton Branch

The Fredericton Branch was inaugurated in 1951.

Activities at Fredericton commenced early in the year when a meeting of the Saint John Branch took place there. A provisional executive was formed and

organization arranged, culminating in the ceremony on Friday, December 7, at which the Fredericton Branch charter was presented to the chairman D. J. Brewer. (This meeting was described in the January issue of the *Journal*.)

Halifax Branch

One important change made in the style of Halifax meetings this year was the introduction of a buffet supper meeting which is usually held at the Nova Scotian Hotel. The supper consists of sandwiches, pie, coffee, etc., and is held at 5.30 p.m., followed immediately by the meeting. The main speaker can usually commence at 6.30 p.m., with ample time provided for discussion and closing the meeting by 7.45 or 8 p.m. at the least. With this type of meeting, attendance has been increased by at least 50 per cent, and the results obtained have been pleasing.

In all other ways the affairs of the Branch remain much the same, but there was an active committee working on the Special Course for Graduates, and it was hoped to have the course under way by the middle of January.

Hamilton Branch

Branch activities have increased with the inauguration of a Juniors and Students course and the expansion of the Engineers Ball programme. Regular meeting attendance has also increased and a plant visit in September to Dominion Foundries and Steel Company's new blast furnace project brought out over three hundred members and guests. The major factors in the increased attendance are the excellent meeting subjects and speakers engaged by the program committee, however, the tireless efforts of all the executive have contributed largely to the general resurgence of member interest.

One committee deserving special mention was the Students and Juniors Paper Competition committee. Ten papers were submitted and preliminary eliminations had to be held to pare the number of contestants for the regular branch competition night in March.

In January "This Business of Engineering" was discussed at the annual meeting. Heat energy, the International Joint Commission, the new Stelco Five-stand Cold Mill, were the subjects of addresses in February, March and April; and a Brantford dinner meeting during the summer included a discourse entitled "You and the Atom."

At the resumption of activities in September, the Students and Juniors Course in Professional Development was inaugurated, and 24 members met weekly to hear a lecture on some topic related to the development of an engineer and to take part in the discussion.

In October, 200 members heard a discussion on Television in Canada, and in November a panel discussed relationships between the prominent professional engineering organizations. In December a panel explained aspects of operating a manufacturing plant.

Kingston Branch

Kingston Branch has enjoyed an exceptionally good year to date, with very definite increases in attendance at monthly meetings. It is believed this is due to an avoidance of formal lectures, and the Branch has endeavoured to promote interest by holding meetings where facilities are available for social refreshments, either before or following the speaker of the evening. Additionally several visits to local industry have proved very popular and it is hoped to extend this type of meeting still further with the approach of early summer.

Kitchener Branch

During the past year a number of general meetings were held on an informal basis at the Officers Mess, Knollwood Park, Kitchener, usually with a buffet lunch being served after the meeting. This lunch was free to those attending, though a plate was left on the table for voluntary contributions of anything from a nickel to a dollar.

Most of the speakers were from points outside of Kitchener, which seems to have some general appeal to the audiences. The attendance in general at the meetings has been improving considerably and the average turnout is somewhere in the neighbourhood of thirty people. At times this varies to fifty.

Several purely technical meetings took place, and these appealed to a smaller group. However, the executive felt obliged to have technical meetings in consideration of the educational objects of the Institute.

Kootenay Branch

The executive of the Branch held seven well attended meetings, and there were six regular Branch dinner meetings, and one evening meeting, with an average attendance of 28.

The visit of Field Secretary L. F. Grant in March was very much enjoyed. He had met with a number of members and prospective members at Nelson, and discussed the forming of a Nelson Section of the Kootenay Branch. The June meeting was at Nelson, so that the newly formed Nelson Section would have an opportunity to attend a Branch meeting, and this was most successful.

In September the Branch entertained a group of E.I.C. members from Vancouver, together with some members of the American Society of Metals. This was in the nature of a plant tour for the visitors, followed by a very enjoyable dinner meeting at which some branch business was discussed. The groups were the guests of Cominco at a luncheon.

The Juniors and Students night, in December, was one of the most interesting meetings, and the interest of the young engineers is considered of great importance.

The topics of the meetings were diversified, and the speakers were visiting engineers, members of the Branch, or prominent members of other professions.

Lakehead Branch

There were eight meetings held this year, four in Port Arthur and four in Fort William.

At three of the meetings very interesting technical papers were given; one by Mr. H. Thomasson, director of metallulgical research and development of Canadian Westinghouse Company, on "Modern Laboratory and its Part in Quality Control;" one by Mr. R. S. Williams, formerly with the Canadian National Railways, on "Diesel Electrics for Railway Service"; and one by Mr. J. L. Gray, chief administrator, Chalk River Atomic Centre, who spoke on "Atomic Development in Canada."

The annual dinner and dance on January 24 was attended by more than 80 couples.

The Student Guidance Committee addressed the students at the Lakehead Technical Institute on the advantages of membership in the Engineering Institute. They also gave lectures on engineering at Careers' Night, at both the Fort William Vocational School and the Port Arthur Technical School.

Lethbridge Branch

A review of the Branch activities for the year results in the following statistics. Five regular meetings were held, with an average attendance of 43. At two special meetings, the average attendance was 75. An average of six members attended the two meetings of the Branch executive.

London Branch

The London Branch enjoyed a successful year. The form of the meetings varied considerably, with an approximate average attendance of 50 members.

Dinner meetings with speakers, seemed to draw the largest crowds, the annual meeting in January being attended by approximately 80 members. An out of town dinner meeting in Woodstock was attended by 100 members and their guests. A most interesting field trip was made to St. Thomas to see the Clevite Company plant in operation. Another interesting meeting was furnished by four branch members who gave an excellent symposium on Heating.

All regular monthly meetings were started at 8.00 p.m. Coffee and sandwiches were usually served.

Lower St. Lawrence Branch

The inaugural meeting of the Lower St. Lawrence Branch was held at Rimouski, Que., on October 12, 1951, with 69 members and prospective members and guests. Dr. Ira P. Macnab presented the provisional executive with the Charter of the new branch and was the guest speaker. The meeting was addressed, also, by Dr. L. A. Wright the general secretary, who discussed the events leading up to the formation of the Lower St. Lawrence Branch. (This occasion was described in the January issue of the Journal.)

On Tuesday, December 11, the newly established branch held the first meeting after its inauguration. Mr. H. Cimon, vice-president of Price Bros. Co. Ltd., addressing the Branch at the dinner, outlined the progress of professional organization of engineers in Canada. A film, shown after Mr. Cimon's talk, described the landing of Allied troops on the Normandy beach.

Moncton Branch

Seven executive meetings were held during the year. There were ten branch meetings, of which three were dinner meetings. One of these dinner meetings was at Bathurst, the first ever held outside Moncton, and with a record attendance of ninety-nine. As an innovation, light suppers, priced at less than one

dollar, were served at two meetings and those proved quite attractive.

During the fall season, various committees were formed and a branch news editor appointed, the idea being to distribute the work of the Branch and increase interest in its activities. The year was notable for the formation of a Branch in Prince Edward Edward Island, formerly Moncton Branch territory.

Montreal Branch

The executive has endeavoured to carry on with the development of technical sections.

During the fall, a more economical bimonthly bulletin announcing meetings was used instead of the weekly postcards, to avoid duplication of addressing.

At a meeting of the Executive Committee held on October 18th, at which the president of the Institute, Dr. Ira P. Macnab was present, it was unanimously resolved that Council be asked to take all possible steps towards the formation of a committee of senior engineers to study and make recommendations that would lead to unity of action of the profession in Canada. This important issue should be given serious attention during the coming year.

A meeting of the Branch was held in Sherbrooke on June 1st, at which the local members signed an application for a Branch charter. This culminated in the inauguration of the Eastern Townships Branch on November 9th.

The executive met eleven times during the year to conduct the business of the Branch and the committee have had an active year, as their reports indicate.

It is a pleasure to report the nomination as President of the Institute for 1952, of one of the hardest workers of the Montreal Branch, Dr. John Stirling.

Twenty-four general meetings were held on Thursdays throughout the year, including Ladies Film Night, an annual student night, and the annual meeting. At other meetings speakers discussed engineering topics in various fields, as well as management, economics, and labour.

The Electrical Section, with R. J. Harvey as chairman, held nine technical meetings, and one plant visit. The chairman of the Chemical Section has been R. L. Dunsmore. This Section arranged one plant tour and three meetings at which speakers discussed technical subjects of interest. The Civil Section with J. E. Hurtubise as chairman, met seven times to hear papers on phases of steel and concrete construction and other topics. The Management Section, at three meetings, under the chairmanship of R. A. Phillips, heard from authorities on collective bargaining, personnel selection and appraisal, and management's responsibility for training.

Chairman of the mechanical section was J. H. Ingham. This section met on ten occasions, when mechanical engineering subjects were discussed by outstanding speakers. The Transportation Section, with chairman O. Duskes, visited transportation centres in Montreal, and at three other meetings heard papers on transportation.

Admission, membership, entertainment, publicity, policy and co-ordination, and student guidance committees were active. The student guidance committee arranged two French speaking forums at which 154 students heard Messrs. Leo Roy and Jacques Benoit. Mr. W. H. Moore spoke at a student guidance conference at Montreal High School.

Chairman of the Junior Section was G. F. Noiseux. Six study groups were active during the 1950-51 season. A plaque engraved with the E.I.C. crest for annual award for the best group report was presented to the labour and management group.

In general the Junior Section had a very successful year of activities. Because of its numerous organizations it was decided at the Annual Meeting of 1951 to increase the number of councillors from four to six.

It is felt today that the Junior Section is a well organized body which represents in general all the young engineers of Montreal, and, that whenever a matter of general interest to all engineers arises, it should be consulted before a decision is made.

In 1951 the Council of the Institute received a request from the Government to loan the services of our General Secretary to go to Europe and Britain as a member of a mission to interview engineers desiring to emigrate to Canada. This request was granted and a report of the mission's activities is given on pages 1191-1193 of the December issue of the *Journal*. This project has caused much discussion among young engineers, so arrangements were made for an open discussion and clarification at a meeting of the Junior Section to be held on February 18, 1952.

Newfoundland Branch

The year 1951 saw a considerable increase in the activities of the Newfoundland Branch highlighted by the formation of a Ladies' Auxiliary.

Monthly meetings of the Branch are now held and usually take the form of an address by a selected speaker followed by a social get-together of the members after the meeting.

The attendance is much better and there is a definite interest on the part of the members in the activities of the Branch. A concentrated effort has been made to obtain new members and the results of the drive are beginning to show in applications for admission to the Institute.

The formation of a Ladies' Auxiliary has been a great spur to the activities of the Branch and a Committee from the Auxiliary provides refreshments for the members after every Branch meeting.

A program of plant visits in conjunction with Provincial Industrial Development program and an annual dance, have been scheduled for the coming months.

The Corner Brook area has had an extremely active year and with their membership steadily increasing, it is expected that they will be set up as a separate section within the near future.

Detailed investigation of matters affecting the Branch have been made by the various sub-committees and the question of Branch Affiliates is now being actively studied with a view to making recommendations covering their admittance.

The Newfoundland Branch both financially and otherwise, has never been in better shape. A good foundation has been laid on which to expand and there is no question that in the next few years, it will be one of the more active units in the Institute.

Niagara Peninsula Branch

The Branch enjoyed a very successful year with several very good meetings. The first annual dance was held in the spring and proved to be very popular.

Another meeting which it is hoped will become an annual fall event was a tour through the H.E.P.C. development under construction.

The largest program undertaken by the Branch was a series of non-technical lectures held once a week throughout this winter. This has been very successful so far, and has an enrolment of 64 with an average attendance of over 75 per cent. The Branch granted $100.00 to the lecture series and each member enrolled is charged $6.00.

Ottawa Branch

The policy of meeting at lunch time has been continued as it is the most favoured in Ottawa. At the two evening meetings which were held jointly with other organizations the attendance from our members was poor. However during the President's visit the membership was canvassed as to their wishes and the resulting dinner and dance was most successful. One other innovation was the buffet supper for the visitors from the Cornwall Branch. It is hoped that more of these will be held in the future.

Cooperation has continued with other associations. A meeting was held jointly with the Royal Astronomical Society on March 1; and a meeting with the Military Engineers Association of Canada on November 19.

The annual meeting was in January, 1951. At two meetings in February, three in March, two in April and two in May, speakers dealt with such subjects as steel controls; fishery problems at Kitimat; "This Business of Engineering;" student and junior engineering training; Ottawa's transportation problem; wind power; and radio.

For the May meeting, N.R.C. made available a cruise on the "Raidel II," and N.R.C. also was the scene of the June buffet supper for visitors from Cornwall.

One meeting in September, one in October, and one in December included discussions on engineering in Europe; atomic energy; and the Ungava iron ore deposit.

November social functions included a smoker, and a dinner and dance on the occasion of the president's visit.

Peterborough Branch

The membership of the Peterborough Branch has highly diversified and specialized engineering interests. For this reason papers presented are not comments on specialized engineering subjects but rather are of general engineering nature, which is well received by the Branch.

The Branch usually extends a courtesy dinner to the guest speaker and arranges an informal gathering with the speaker after the meeting to provide pleasant occupation for him until bedtime or train-time.

Seven meetings were held with average attendance of about 50. The most enjoyed meeting has been the annual summer outing. This past year an ex-

Membership and Financial Statements o

BRANCHES	Belleville	Border Cities	Calgary	Cape Breton	Central British Columbia	Cornwall	Eastern Townships	Edmonton	Fredericton	Halifax	Hamilton	Kingston	Kitchener	Kootenay	Lakehead	Lethbridge
MEMBERSHIP																
Resident																
Hon. Members	..	..	..	..	1	..	..	..	..	..	..	1	..	..	..	..
Members	41	71	180	45	18	23	23	187	73	227	132	60	19	20	42	25
Juniors	16	45	75	31	13	7	14	142	29	59	105	47	19	13	25	10
Students	25	72	82	13	19	19	28	178	56	175	142	154	18	28	38	12
Affiliates	2	1	1	1	..	2	..	2	..	1	..	..	2	..	6	.
Total	84	189	338	90	51	51	65	509	158	462	379	262	58	61	111	47
Non-Resident																
Hon. Members	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	
Members	..	20	12	9	3	6	8	33	..	77	2	6	..	13	9	16
Juniors	..	10	11	10	..	3	3	34	..	27	3	3	..	8	18	4
Students	..	13	13	4	4	2	12	31	..	60	2	10	..	26	17	8
Affiliates	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
Total	..	43	36	23	8	11	23	98	..	165	7	19	..	47	44	28
Grand Total Dec. 31st, 1951	84	232	374	113	59	62	88	607	158	627	388	281	58	108	155	75
" " Dec. 31st, 1950	59	207	340	112	53	58	..	552	..	592	346	152	67	98	146	78
Branch Affiliates, Dec. 31st, 1951	11	..	45	..	8	12	..	2	..	..	14	..	2	1	7	34
FINANCIAL STATEMENT																
Balance as of December 31st, 1950	143.96	1,017.98	355.29	359.03	24.86	128.84	..	608.51	..	348.27	17.04	190.27	64.53	64.53	241.18	109.
Income																
Rebates from E.I.C. Hq	213.00	489.30	176.00	263.00	107.40	144.30	..	295.00	..	257.00	662.00	394.20	147.60	234.00	291.90	38.
Payments by Prof. Assns	..	..	570.51	160.65	..	..	..	758.66	..	769.50	..	..	..	..	..	125.
Branch Affiliate Dues	30.00	..	258.06	180.00	49.00	24.00	..	..	..	..	70.50	..	..	..	49.00	96.
Interest	..	11.59	32.10	..	..	..	0.12	..	..	3.33	72.64	..	..	..	3.00	
Miscellaneous	..	1,263.89	..	1,337.78	..	388.20	200.00	465.03	..	102.51	613.40	74.70	40.00	..	10.83	40.
Total Income	243.00	1,764.78	1,036.67	1,941.43	156.40	556.50	200.12	1,518.69	..	1,132.34	1,418.54	468.90	187.60	234.00	354.73	300.
Disbursements																
Printing, Notices, Postage①	52.64	217.88	322.67	103.73	52.74	25.95	48.63	373.80	..	385.48	441.27	63.68	54.21	24.00	78.13	57.
General Meeting Expense②	70.00	34.50	220.08	24.00	19.62	20.00	..	272.30	..	53.85	..	8.00	39.40	93.58	..	63.
Special Meeting Expense③	..	1,577.88	171.65	1,530.88	..	416.75	..	163.60	..	298.60	195.60	141.74	29.10	..	211.09	..
Honorarium for Secretary	..	..	..	..	..	..	..	100.00	..	100.00	..	..	..	..	16.48	25.
Stenographic Services	..	25.00	10.00	10.00	5.00	..	..	5.00	..	70.00	50.00	..	..	..	..	
Travelling Expenses④	..	..	..	..	..	..	..	..	..	75.00	..	..	..	..	..	..
Subs. to other organizations	..	..	..	..	..	6.72	..	..	..	..	..	..	..	..	..	.
Subs. to *The Journal*	..	..	6.15	..	15.10	..	..	..	..	..	..	..	..	8.15	10.15	14.
Special Expenses	6.09	17.50	22.00	8.00	..	..	..	59.75	..	84.39	112.91	..	7.58	..	..	2.
Miscellaneous	..	1.00	13.01	1.95	4.36	11.60	..	106.63	..	76.30	233.30	97.15	..	11.59	1.35	8.
Total Disbursements	128.73	1,873.76	765.56	1,678.56	96.82	481.02	48.63	1,081.08	..	1,243.62	1,033.08	310.57	130.29	137.32	317.20	171.
Surplus or *Deficit*	114.27	*108.98*	271.11	262.87	59.58	75.48	..	437.61	..	*111.28*	385.46	158.33	57.31	96.68	37.53	129.
Balance as of December 31st, 1951	258.23	909.00	626.40	621.90	84.44	204.32	151.49	1,046.12	..	236.99	402.50	348.60	121.84	161.21	278.71	238.

①Includes general printing, meeting notices, postage, telegraph, telephone and stationery.

②Includes rental of rooms, lanterns, operators, lantern slides and other expenses.

③Includes dinners, entertainments, social functions, and so forth.

④Includes speakers, councillors or branch officers.

he Branches as at December 31, 1951

	Lower St. Lawrence	Moncton	Montreal	Newfoundland	Niagara Peninsula	Ottawa	Peterborough	Prince Edward Island	Quebec	Saguenay	Saint John	St. Maurice Valley	Sarnia	Saskatchewan	Sault Ste. Marie	Sudbury	Toronto	Vancouver	Vancouver Island	Winnipeg
..	1	..	3	..	..	2	..	..	..	..	1	..	..	..	..	..	2	..	..	1
59	28	44	1,473	21	103	368	46	22	126	77	68	76	56	195	25	26	591	243	81	231
47	17	14	738	16	71	96	19	3	79	57	17	80	78	63	9	20	383	117	23	119
47	15	24	1,254	29	56	266	42	5	254	44	15	60	8	83	11	24	409	417	42	288
2	1	..	16	1	2	4	2	..	2	..	2	1	..	..	1	2	7	5	..	3
55	62	82	3,484	67	232	736	109	30	461	178	103	217	142	341	46	72	1,392	782	146	642
.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
0	..	34	73	22	1	50	10	..	9	2	72	10	..	64	29	16	35	24	12	23
4	..	20	44	7	2	24	6	..	9	3	20	8	..	14	31	13	63	23	7	29
0	..	31	54	22	..	43	8	..	8	3	72	11	..	..	24	7	53	70	23	27
.	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	1	1	1	..	..
4	..	85	171	51	3	117	24	..	27	8	164	29	..	78	84	37	152	118	42	79
9	62	167	3,655	118	235	853	133	30	488	186	267	246	142	519	130	109	1,544	900	188	721
0	..	182	3,809	95	217	807	169	..	337	146	278	216	123	470	135	82	1,205	984	187	683
.	..	2	8	..	..	12	11	..	..	..	16	1	..	..	..	3	..	..	1	23

*For voting purposes only, there should be added to Montreal Branch, an additional 556 members, 341 resident in the United States, 135 in British possessions and 80 in foreign countries.

17.15	..	633.32	5,677.22	109.21	592.24	302.99	308.24	..	591.21	543.69	546.18	302.46	157.37	125.11	684.09	221.36	2,044.33	406.13	102.85	1,914.53
1.00	100.00	150.30	6,157.27	233.00	553.00	1,405.00	249.00	100.00	748.00	556.80	259.50	543.00	346.20	82.40	299.00	297.00	2,370.00	992.90	355.00	822.00
.	..	122.00	..	..	..	..	..	..	..	..	252.00	..	..	654.42	..	..	..	..	..	399.75
.	..	5.00	57.00	..	..	76.00	26.00	..	..	..	104.85	..	..	..	52 00	..	..	..	3.00	130.00
3.00	..	3.20	90.00	..	18.20	32.06	..	..	..	..	..	..	..	..	9.00	..	30.48	13.39	..	36.00
8.40	583.98	482.15	2,521.37	147.25	..	967.50	143.40	..	218.03	692.25	156.34	248.98	761.62	..	264.70	69.55	1,149.42	739.51	..	383.41
2.40	683.98	762.65	8,825.64	380.25	571.20	2,480.56	418.40	100.00	966.03	1,249.05	772.69	791.98	1,107.82	736.82	624.70	366.55	3,549.90	1,745.80	358.00	1,771.16
3.85	99.62	129.75	2,456.14	5.00	203.70	589.72	89.86	..	117.13	43.97	154.93	112.06	48.04	159.96	76.70	136.04	852.47	498.06	100.03	666.71
2.33	..	25.32	961.75	15.36	39.75	985.46	102.75	76.40	27.63	18.00	6.00	..	983.87	263.86	247.53	48.91	414.26	..	22.50	10.00
8.70	453.09	547.55	2,410.50	243.13	222.54	36.60	261.52	..	524.58	1,177.22	415.64	508.80	..	..	80.10	18.00	1,222.08	1,035.69	..	460.41
.	..	50.00	830.00	..	75.03	..	..	..	125.00	40.00	60.00	25.87	..	120.00	25.00	..	100.00	50.00	35.00	100.00
0.00	..	..	..	..	15.00	125.00	..	..	25.00	..	..	..	..	..	..	..	31.35	3.00	..	..
.	..	..	..	..	..	..	..	..	..	25.00	..	11.68	..	110.80	..	..	..	..	..	25.00
.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3.00
.	..	4.15	12.00	..	..	..	6.00	..	..	..	36.00	..	..	..	16.00	..	..	..	..	52.00
1.56	29.10	..	543.42	40.00	100.00	210.96	..	..	25.47	..	..	104.13	52.00	..	52.50	..	95.95	178.20	39.64	30.00
.	..	15.18	338.87	10.00	7.65	76.48	39.51	..	18.86	.90	15.73	1.38	132.00	..	1.00	9.71	450.00	70.14	..	13.03
6.44	581.81	771.95	7,552.68	313.49	663.67	2,024.22	499.64	76.40	863.67	1,305.09	688.30	763.92	1,085.23	654.62	498.83	212.66	3,166.11	1,835.09	197.17	1,360.15
4.04	102.17	*9.30*	1,272.96	66.76	*92.47*	456.34	*81.24*	..	102.36	*56.04*	84.39	28.06	22.59	82.20	125.87	153.89	383.79	*89.29*	160.83	411.01
3.11	102.17	624.02	6,950.18	175.97	499.77	759.33	227.00	23.60	693.57	487.65	630.57	330.52	179.96	207.31	809.96	375.25	2,428.12	316.84	263.68	2,325.54

periment with a "smoker" and symposium paper was a distinct success.

Prince Edward Island Branch

The pre-organizational meeting was held in Charlottetown on September 26, 1951, while Dr. I. P. Macnab and Dr. L. Austin Wright were in the city to attend the Canadian Association of Community Planners convention. At this meeting the engineers on Prince Edward Island prepared a petition to the Engineering Institute of Canada requesting that a charter be granted for the formation of a Branch of the E.I.C. on Prince Edward Island.

At the October meeting of the Institute Council the application for the formation of the Branch was approved, as well as 16 new applications for membership in the Institute.

The inaugural meeting was held in the Charlottetown Hotel on December 12, 1951, with 64 persons present. Dr. Macnab and Dr. Wright were present for this occasion, and the charter of the Branch was presented to Chairman W. K. Sharpe by Dr. Macnab. (This occasion was described in the January issue of the Journal.)

Quebec Branch

The Executive Committee held six meetings with an average attendance of nine members, for the transaction of Branch business.

The activities of the Branch were varied and well attended.

Social functions and film nights were better attended. During the next year a new policy will be adopted, providing talks on subjects other than engineering.

The annual meeting of the Branch was in January, 1951. President Vance visited Quebec in March, and President Macnab visited the Branch in October. The annual golf tournament in September drew an attendance of 92.

Subjects of papers at the February and November meetings were "Utilisation des minérals de fer"; and "Another Triumph of Canadian Engineering". At the November meeting, with 95 present, four films were shown.

Saguenay Branch

The Branch programme consisted of nine meetings. Three technical papers were presented and invitations were extended to non-members for all three. Two smokers were held, one in March to welcome President Vance, and one in September for the annual branch meeting. This latter was an innovation and proved very successful in getting members out to review the past year's activities and discuss plans for 1951-52 branch program.

There were two dinners, one in January to entertain President Vance, who unfortunately could not attend and was represented by Vice-President J. F. Wickenden. The second dinner was in October on the occasion of President Macnab's visit.

One field trip was made to the district power developments. The second annual mixed party in May proved successful and has been established as an annual feature.

The Junior Section attended nine meetings. Four technical papers were presented by the Junior members themselves. Two smokers were held, at one of which a debate was presented, and the other featured talks by two returned prisoners of war. In addition two film nights were held, one on the occasion of the Section annual meeting, the other- for a Ladies Night. For the annual dinner in April, there was a guest speaker.

Saint John Branch

During the past year the highlight of the activities of the Branch was the joint dinner with the Association of Professional Engineers on April 4. This was in connection with the annual meeting of the Dominion Council, which was held in Saint John this year. The next evening a similar meeting was held in Fredericton, although it was not an official branch affair. The Branch's Fredericton Committee organized the programme.

For the third consecutive year a branch meeting was held in Fredericton. It is believed that these meetings started the activities leading to the formation of the new branch.

The attendance and the form of the meetings was very much as in the past.

St. Maurice Valley Branch

The activities of the Branch for the past year were few. Perhaps one of the best meetings was a discussion of civil defence by Brig. G. Gauvreau of Montreal.

Plant tours under the auspices of the Junior Sections have been very well attended, particularly by new engineers in the district. At technical talks, attendance has been poor . Speakers on topics of a more general nature have been obtained for 1952 in the hope that attendance will improve. More joint meetings with other organizations will be held.

In general, it is felt that more advanced planning will provide more activities of interest to the majority.

Sault Ste. Marie Branch

The Branch held seven dinner meetings throughout the year. Five of them were honoured with guest speakers whose topics were of general interest and not confined too much to one specific field of engineering.

One meeting was held in the spring to bring the members together to air their views on branch policy, etc. The purpose was to stimulate interest and make any changes in style of meetings to suit the majority. This meeting proved quite successful with 50 per cent of Branch resident members attending. No change in the type of meeting was adopted, but the style of papers to be presented was discussed thoroughly.

The over-all attendance at meetings increased considerably, with renewed interest being shown by many.

The annual meeting was postponed until January 11, 1952, to allow a special paper on Nuclear Physics to be presented on November 30.

Sarnia Branch

During the year of 1950 the Sarnia Branch held thirteen general meetings and fourteen executive meetings.

Of the general meetings two were joint meetings with the local branch of the Chemical Institute of Canada, at which the two groups alternated as hosts. Another meeting was with the Sarnia Institute of Power Engineers, at which this latter group acted as hosts.

A joint meeting was held with the Border Cities Branch at Chatham.

Of the remaining meetings five were dinner meetings, three were evening meetings and one was a dinner meeting combined with a field trip to the G.M. Diesel Plant at London, Ont. This last meeting was sponsored and complete arrangements made by the Junior members of the branch.

The branch was honoured by visits from President Vance in March and President Macnab in October, which were the occasions of very enjoyable dinner meetings with the ladies present.

Colonel Grant visited the branch during November to discuss, among other matters, details of a development program for juniors. A program such as discussed at that time has since been successfully inaugurated, with Colonel Grant delivering the introductory talk.

Meetings have averaged approximately 60 members per meeting, with no apparent preference shown by attendance at least, for any particular form of meeting.

During the year a questionnaire was circulated to the membership by this Special Projects Committee in an attempt to find the majority opinions of members on subjects for talks, special study groups and new ideas. Approximately 35 per cent of the members responded and the results are being used in future plans.

Saskatchewan Branch

Eight meetings were held jointly with the Association of Professional Engineers of Saskatchewan.

The September meeting was in Moose Jaw, the speaker being Dr. L. B. Thomson, director, Prairie Farm Rehabilitation Act, on the subject "The Economics of Irrigation on the Prairies". There was an attendance of over 90, including members from Regina, Saskatoon and Swift Current.

Regina meetings were highlighted by Mr. Patton's paper on the Saskatchewan Landing Bridge and Mr. Winnitoy's on Bituminous Surfacing practices.

Sudbury Branch

The branch held eight dinner meetings during the past year, there being no activities held during the months of June to September. Attendance averaged 56 per meeting, which cannot properly be compared to the previous year, in which the Branch was inaugurated and only four general meetings were held.

Dinner meetings appeared to be favoured by the majority of the members, due mainly to the fact that the meetings are attended by a considerable number of non-resident members who have to travel up to 80 miles to Sudbury. As a consequence, dinners are not held until 7 p.m., followed by the business meeting and the speaker of the evening.

Two Ladies' Nights were held, one on the occasion of the annual meeting, and the second at the time of the president's visit, both very successful meetings.

One meeting was held at Espanola, Ont., when members, as guests of the Kalamazoo Vegetable Parchment Company were conducted on a very interesting tour through the paper mill prior to the dinner meeting.

Toronto Branch

During 1951, the Toronto Branch held meetings at which papers were presented both of general interest and of a more specialized technical nature. Both types of meetings were well attended.

Early in the year a questionnaire was addressed to the membership to ascertain the preference of the members as to type and number of meetings. The majority of answers returned indicated a preference for one meeting a month at which meeting a paper be presented of general interest. This has been carried out. A sufficient number of returns indicated however a wish for technical papers and to satisfy this, a second meeting in each month was arranged at which meeting a technical paper was presented. In some cases these technical meetings were held jointly with other technical societies.

The Branch has cooperated with the Field Office in supporting the course for Junior Engineers inaugurated by the Field Secretary. So enthusiastic were those attending the first course that the enrolment of the second course was double that of the first course.

Vancouver Island Branch

The activities of the Vancouver Island Branch during 1951 included five executive meetings, and six general lecture meetings. Two field trips were arranged.

Vancouver Branch

The average attendance at meetings, field trips, and dinners during the past year was 90.

Titles of papers heard at the January, April and November meetings were "Some Engineering Problems in the City of Vancouver," "Pitting and Cavitation of Turbine Runners," Medicine and Machines." In February, March and April, activities consisted of Students Night, a film showing, and the homecoming dinner for Chris Webb.

Six field trips were arranged during the year, and groups visited the new U.B.C. Engineering Building, the Clayburn Company, Powell River, the Shelburn Refinery, Trail, and the Fraser River Model at U.B.C.

Ladies' Night took place in October.

Winnipeg Branch

During the year 1951 the management committee of the Winnipeg Branch held 11 executive meetings, the average attendance being 10. In addition, members of the management committee visited Brandon on two occasions, June 9 and October 22, to assist in the formation of a section there.

With the exception of the annual meeting, all general meetings of the Branch were held jointly with the Association of Professional Engineers of Manitoba. Ten meetings were held during the year, the average attendance being 100. In addition, the ceremony of signing the Co-operative Agreement with the Association took place at a dinner meeting at the Fort Garry Hotel on February 22, with an attendance of 115. The annual banquet and dance of the Association and the Winnipeg Branch was held on March 29 at the Royal Alexandra Hotel.

The Brandon Section of the Winnipeg Branch was formed on October 22. Officers elected were W. W. Fotheringham, Chairman, G. W. Lawson, Vice-Chairman, and W. J. Hodge, Secretary. Three general meetings have been held by the Section with an average attendance of 23.

The Electrical Section held 8 general meetings during the year, with an average attendance of 56. Also, two dinner-dances were held on March 2 and November 23 in the Marlborough Hotel with attendances of 195 and 214 respectively. The Section's excursion by train to the City Hydro Pointe du Bois and Slave Falls power plants on July 7 was enjoyed by 196 members and ladies.

The Student Section held 9 meetings in 1951 with an average attendance of 100. These were all noon-hour meetings in the University Engineering Building.

Make a note of these important dates

MAY 7, 8, 9

. . . they are the days of the

66th Annual General and Professional Meeting

of

THE ENGINEERING INSTITUTE OF CANADA

at

VANCOUVER, B.C.

FROM MONTH TO MONTH

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

Ernest Albert Cleveland

1874 - 1952

President of the Institute, 1936

The death of Ernest A. Cleveland, LL.D., M.E.I.C., occurred at his home in Vancouver, B.C., on January 8th, 1952. Dr. Cleveland was one of the most outstanding pioneers of the engineering profession on the west coast and had been active for more than 60 years.

Born on May 12th, 1874, at Alma, New Brunswick, Dr. Cleveland, after receiving his early education there, went to Vancouver in 1890 where he became an articled pupil to William Bros & Dawson, engineers and surveyors of that city. On completing his articles he worked for a time for the late T. A. Noble on hydro-electric surveys and in 1894-1895 became an assistant on the International Boundary Surveys in Alaska. In the following year he received his commission as British Columbia land surveyor and Dominion land surveyor.

After a period spent in triangulation surveys for the provincial government, he was able to devote some time to engineering study at the University of Washington. Following this he joined the British Columbia Exploring Syndicate for work on mining exploration and operation on the coast and in the interior of the province. During the next four years he made surveys and investigations for hydro-electric power developments and railways.

In 1904 Dr. Cleveland commenced private practice, largely in connection with mining properties, and in 1910 became a partner in the firm of Cleveland and Cameron, Vancouver, which soon developed a large general practice as engineers and surveyors. His partner in the firm was Donald Cameron, who when city surveyor of Exeter, England, developed the septic tank. During 1912-1914 the firm was associated with Sir John Wolfe Barry and Partners in connection with a project for a bridge over the Second Narrows in Vancouver harbour. This bridge, however, was not constructed.

In 1919 Dr. Cleveland was appointed Comptroller of Water Rights for the Province of British Columbia, Chairman of a Board of Investigation under the Water Act, and consulting engineer to the Department of Lands. During this period he was responsible for the design and construction of the Southern Okanagan irrigation project and also conducted a reconstitution and refinancing of the larger irrigation projects in the province, as well as general supervision over their reconstruction. In 1926 he was appointed Chief Commissioner of the Greater Vancouver Water District and Chairman of the Vancouver and Districts Joint Sewerage and Drainage Board, which offices he held until his death. Dr. Cleveland

Dr. Ernest A. Cleveland, M.E.I.C.

was a member of the American Society of Civil Engineers and of the American Water Works Association. Since 1926 he had been an active member of the Vancouver Town Planning Commission, and in May, 1936, the honorary degree of Doctor of Laws was conferred upon him by the University of British Columbia on the occasion of that institution's twenty-first anniversary. He became a member of the Institute in March, 1914, served as a member of Council in 1927, and as president in 1936. As chairman of the local advisory committee he was largely responsible for the great success of the Institute's Western Professional meeting held in 1934 in conjunction with the American Society of Civil Engineers.

Those who have worked with Dr. Cleveland will not need any description of his genial personality and capacity for leadership. But to those who have not served with or under him it may be said that his outstanding position in the public life of Vancouver is due also to his technical competence as an engineer, his knowledge of affairs, his skill in dealing with contentious problems, his ability in directing discussion and his achievements as a public servant.

Besides his widow, Catherine, Dr. Cleveland is survived by three sons: Courtney, E., M.E.I.C., of Calgary; Howard D. of Vancouver; and Ernest A. of Victoria; one daughter Mrs. C. R. Dunlop of Kingston; one sister, Mrs. C. M. Rolston of Vancouver; and four grandchildren.

Ontario Association Annual Meeting

The annual meeting of the Ontario Association of Professional Engineers was held at the Royal York Hotel, Toronto, on Saturday,

O. D. Johnston, M.E.I.C.

January 26th. Reports of the various committees were presented during the morning and discussed by the members present. At noon the usual reception was held followed by the annual luncheon which this year was addressed by Sir Vincent de Ferranti, M.C., Hollinwood, Lancs., England, chairman of the International Executive Committee of the World's Power Conference and chairman of the board of Ferranti Limited of England. Sir Vincent dealt in his address with the significance of Canada's industrial growth.

The new officers and members of council for 1952 were announced and introduced to the members present. Heading the new executive was Oswald D. Johnston, M.E.I.C., the incoming president. Mr. Johnston is president of Gooderham & Worts Limited of Toronto and he succeeds W. H. M. Laughlin, M.E.I.C., of the consulting firm Proctor, Redfern and Laughlin of Toronto. Mr. Johnston was born in Glengarry County, Ontario, and received his early education in Ottawa. He served during the first world war in the Canadian Expeditionary Force and after the war attended the University of Toronto where he graduated in chemical engineering in 1923. He joined the Gooderham & Worts organization in 1937 as manager of their industrial division and was made vice-president in 1941. Mr. Johnston became president of the company in 1948 which office he now holds.

Other officers elected for 1952 were J. Herbert Smith, M.E.I.C., Toronto, manager Apparatus Division, Canadian General Electric Co. Ltd., 1st vice-president; and Professor W. L. Sagar, M.E.I.C., Department of Civil Engineering, University of Toronto, 2nd vice-president. Councillors elected for the coming year are (Civil) Norman A. Eager, M.E.I.C., vice-president, Burlington Steel Co. Ltd., Hamilton, and Robert C. McMordie, M.E.I.C., H.E.P.C., Toronto; (Chemical and Metallurgical) Lee D. Dougan, assistant manager, Polymer Corp. Ltd., Sarnia, Ont., and Gordon R. Smye, chief chemist, Firestone Tire and Rubber Co. Ltd., Hamilton; (Electrical) Archie M. Doyle, manager, Apparatus Department, Canadian General Electric Co. Ltd., Toronto, and Alfred W. Murdock, assistant manager of personnel, H.E.P.C., Toronto; (Mechanical and Industrial) John R. Montague, M.E.I.C., director of engineering, H.E.P.C., Toronto, and Lawrence C. Sentance, M.E.I.C., manager, Manufacturing Department, Canadian Westinghouse Co. Ltd., Hamilton; (Mining) Charles C. Huston, consulting mining engineer, Toronto, and Howard S. Robinson, chief geologist McIntyre-Porcupine Mines Ltd., Toronto.

This Generation's Outlook

The following editorial is reproduced by kind permission of the managing editor of the Halifax Mail Star, *in which publication it appeared originally.—Ed.*

When, immediately after the war, educators, industrialists and engineers saw veterans rush into universities searching for engineering training they were appalled. Gloomy forecasts were made about the ability of the economy to absorb the thousands who soon would be emerging with degrees. Well, they have emerged; engineering classes have subsided to something resembling what was the normal — and there is still an acute shortage of men with science degrees.

This applies to Canada and to the United States and the situation is so serious that at a conference of the Federal Security Agency officials in Washington a few days ago a national campaign to interest youth in practical scientific training was decided upon. This campaign will include the establishment of scholarships to hold boys — and girls — in high schools to complete their

Cover Picture

A new process for removing sulphur from iron has been developed at the Sorel plant of the Quebec Iron and Titanium Corporation.

Slag-forming materials in granular form are injected into the furnace by means of a lance, using nitrogen gas under pressure as the carrier. The picture illustrates the lance being inserted into a furnace.—*Photo courtesy of Canadian Liquid Air Co. Ltd.*

courses, which they now quit halfway through, and continue into engineering courses. No such proposal has been considered in Canada as yet but the day may well be coming when something of the sort will have to be undertaken.

The world is operating increasingly on an intensively mechanized basis. Engineers are required for the planning and conduct of that operation. They are called for in the research and inventive sphere. None other can take their place and when they are missing technological progress ceases. There may be undesirable aspects to this emphasis on the practical. Perhaps it would be socially sounder to stress Latin and Philosophy and the other abstractions. On the other hand, the engineers are making possible the machines which make men free for more leisurely contemplation of such subjects.

The destiny of this generation may be to create the physical background for another age of philosophy, art and the niceties of unhurried living. It was so in the Columbian and Elizabethan era. Then men looted the New World to nurture a society which produced fine writing, great painting and deep thinking. While it may be less inspiring to lay the foundation of a cathedral of fine living, as they did, than to decorate its ceiling, it is obvious which now has to come first. Perhaps it is our doom to have to loot the only New World the early adventurers could not get at, the world opened by science. There is every appearance of it and, that being so, this country, like its neighbour, perhaps should turn its hand more effectively to producing more engineers. Only by such means will it earn enough to feed its culture.

Centennial of Engineering - 1952

The Centennial of Engineering, which is being sponsored by 41 national and international groups that include in their membership the great majority of the engineering profession in the United States, will mark the 100th anniversary of the establishment of engineering as a recognized civilian profession in this country.

Filling of the last vacancies on the Centennial's board was consummated with acceptance of their election by David Sarnoff, chairman of the Radio Corporation of America; James M. Todd of James M. Todd Associates of New Orleans, and past president of the American Society of Mechanical Engineers; and Gano Dunn, president of the J. G. White Engineering Corporation, of New York.

Other prominent members of the board include Herbert Hoover, only living former President of the United States; Charles F. Kettering, General Motors research consultant; Benjamin F. Fairless, president of the U.S. Steel Corporation; and Dr. Robert E. Wilson, chairman of the Standard Oil Company of Indiana.

Officers of the Centennial in addition to Lennox R. Lohr, president, are Carlton S. Proctor, of New York, president of the American Society of Civil Engineers, vice-president; Titus G. LeClair, Commonwealth Edison Company, Chicago, and past president of the American Institute of Electrical Engineers, treasurer; and Charles F. Kettering, Chairman of the executive committee.

Frank W. Edwards, on loan from Illinois Institute of Technology where he heads the department of civil engineering, is general manager of the Centennial; while E. L. Chandler, A.S.C.E. staff executive is secretary of the convocation committee.

Adoption of the slogan, "Human Well-Being Through Engineered Progress", to tell how engineering as a profession has set the pace for American progress since the first recognized civilian engineering society came into existance in the United States in 1852, was announced by the Centennial's president.

Thinking behind the slogan was voiced by Karl T. Compton, chairman of Massachusetts Institute of Technology. He said:

> "There is surely a close relationship between the work of engineers and the high standard of living arising from the high per capita production in the United States. Among our professions, that of engineering is out-ranked in numbers only by teaching and nursing. In no other country is this profession of such high standing. Furthermore, the demand for engineers continually exceeds the supply, and this is because our free enterprise system gives almost limitless opportunity and very great incentive to make things new and to do things better."

The Centennial slogan will be featured by leading industries during 1952 in all sorts of advertising and in special books and movies being prepared for distribution to the schools and colleges of the country. It will also keynote the new exhibit of world-famed engineering accomplishments to be staged at the Museum of Science and Industry in Chicago during the five-year period starting in mid-1952, and a summer-long pageant also to be conducted at the Museum next year.

Impetus has been given to the rounding-out of the great convocation of national and international engineering societies to be held in Chicago next September as part of the celebration of the Centennial of Engineering, with the election of Chancellor Henry T. Heald of New York University to the chairmanship of the convocation committee.

Other members of the committee are E. R. Weidlein, president of the Mellon Institute of Industrial Research, at Pittsburgh; Frederick V. Geier, president of the Cincinnati Milling Machine Co., Cincinnati; A. P. Greensfelder, chairman, Fruin Colnon Contracting Co., St. Louis; and E. G. Bailey, vice-president, Babcock and Wilcox Company, New York.

During the Centennial convocation, there will be individual symposia and technical meetings on problems being encountered in almost every phase of engineering. More than a hundred nationally known speakers will participate. In addition, prominent laymen will appear on the panels to express what the general public expects from the engineering profession in the continued advance of American social and economic standards.

At least 25,000 representatives of 41 national and international engineering societies are expected in Chicago for the convocation, according to the Centennial president.

Erratum

A misquotation occurred in connection with the paper "Rotary Lime Kiln Operation" in the December, 1951, issue of *The Engineering Journal*.

In the synopsis box on page 1177 it was stated that the carbide plant of Shawinigan Chemicals Limited is the largest in the world. Mr. R. H. Hall, the author of the paper, in pointing out this error, advised that there is at least one in Germany, for instance at Knapsack, with larger capacity.

Junior Engineers' Courses

The original junior engineers' course which was conducted in Toronto in January, February, and March in 1951 was sufficiently successful to warrant similar enterprises elsewhere. The Field Secretary discussed this at all the branches which he visited during the autumn of 1951, and courses are now (December 15th) being offered to junior and student members of the Institute by the Halifax, Toronto, Niagara Peninsula, Hamilton, Sarnia, and Border Cities branches. Other branches which are considering operating courses are Cornwall, Ottawa, London, Kitchener, Sudbury and Sault Ste. Marie.

In nearly every case it has been necessary to limit the number of students because of the size of the room available, but at present about 250 young engineers are attending in the six branches where the courses are being held. By January 15th it is hoped that there will be between three and four hundred.

In general, the success of a course depends upon three or four junior engineers who have the enthusiasm and powers of leadership necessary to do the work of organization. So far no branch has failed to find such young men. Behind them stands the branch executive, giving them moral support and ready to lend a hand where necessary. But the juniors run it themselves.

Most courses follow a routine at their meetings, the routine beginning with the chairman and introducer for the evening taking the speaker to dinner, and then on to the meeting. Normally the speaker needs about an hour for his main address, after which the class breaks up into groups of from six to ten (under a different group leader every night) which discuss the lecture.

The cost of a course is met by an individual charge to the students of from $5 to $8 and by a contribution from the branch itself which however should not be so large as to handicap the usual activities of the branch. In every case but one this has been found quite enough. If, as is usual, a good room can be obtained at a nominal cost, the student and branch contributions are quite adequate. If a course is considered to be desirable at any branch, the project should never be turned down because of lack of funds.

The question has been raised of admitting senior members, and there can be no objection to this, provided that space and other facilities are available. It is also quite proper to allow junior members of sister engineering societies to join, if the branch considers it desirable, but such non-members of E.I.C. would, of course, be charged a slightly higher individual contribution.

A lecturer addressing the audience.

A discussion group.

It is considered good practice to invite, in turn, the employers of the students to attend one or more lectures. In one city some employers are paying the fees of their employees.

Given the enthusiasm and interest of two or three young men, operating one of these courses will be found to be surprisingly simple, and will also be found to be a very constructive step in the activities of the branch.

As an example of what is being done, the following is a report on the course being conducted by the Niagara Peninsula Branch under the chairmanship of John S. Ellis, Jr.E.I.C.

In the spring of 1951, Colonel L. F. Grant, Field Secretary of the Institute, and the executive of the Niagara Peninsula Branch decided to launch a course on non-technical

The Niagara Branch committee for the course for junior engineers, and Colonel L. F. Grant. Left to right: H. Joe; D. Smith; W. Scott, vice-chairman; Col. Grant; G. Ince, treasurer; J. Ellis, chairman; and H. Rynard.

subjects which would benefit the Junior Engineers of the Branch. The Branch granted $100.00 towards this project and an organizing committee was formed. The purpose of the course was to advance the junior engineer's knowledge of social, political, and business affairs.

The committee circularized the junior engineers of the Branch and over 60 per cent joined the course by paying the $6.00 fee. This meant that sixty-five engineers had to be accommodated. Mr. A. S. Robertson, M.E.I.C., Manager of the Niagara Region of The Hydro-Electric Power Commission of Ontario, very kindly granted the use of a fine hall in the Queenston Powerhouse, free of charge. Meetings are held once a week and the lectures are on the following subjects: public speaking, engineering societies, labour relations, report writing, balance sheets, Canadian and American foreign policy, investment policy for the individual, law and engineering, supervision and industrial management, selective reading, economics of inflation, our political parties, and municipal government.

The photographs appearing on these pages illustrate a typical meeting. The lecturer's address lasts for one hour after which the audience breaks up into six discussion groups. The discussion period takes about three-quarters of an hour and then the audience reconvenes and the discussion leaders report the results of their discussions. By rotating the officials of the meetings and the discussion leaders, each participant has the opportunity to speak at least twice to the audience.

The committee has been fortunate in securing outstanding lecturers and the interest of the members is evidenced in that the average attendance is above 75 per cent and several participants travel over thirty miles to be there. Six junior engineers have joined the Institute to avail themselves of this educational programme.

Canadian Construction Association

Report of the Standard Practices Committee Year 1951

Your Standard Practices Committee has again spent a considerable amount of time on the Standard Contract Forms for Lump Sum Contracts. This work has centred chiefly around the Province of Quebec where the law concerning arbitration is somewhat different than in the other Provinces. I am glad to report that through the efforts of our Vice-President, Mr. P. G. Wilmut, who is the father of all of our standard forms of contract, these difficulties concerning arbitration have been overcome to the satisfaction of all the Provinces and the forms have now been printed. Furthermore, copies of this new form are in the hands of the Engineering Institute of Canada with our hope that very soon this revised form will be adopted and used by the Engineers as well as the Architects across Canada.

It is very gratifying to see the increase in the sales of our Standard Forms of Contract and thereby know that they are being used more and more each year and in all sections of Canada. I urge most heartily that each and every member of the Association insist on the form being used wherever possible.

At our last annual meeting your Committee on Standard Practices was instructed to invite the Royal Architectural Institute of Canada and the Engineering Institute of Canada to each delegate two representatives to discuss with two members of your Committee the complaints made by members of our Association of the methods and practices of calling for tenders. I am glad to report that both Institutes responded readily and named their representatives.

A meeting was in due time called and nine subjects were discussed. The arguments put forward were open and frank by all members and agreement was reached on each subject discussed. It must be borne in mind that agreement on any point of discussion by such a Committee does not, by any means, make out of our recommendations a law. I feel sure that each of the participating Institutes will give our views publication through their respective Journals and I hope that our views will be circularized among our members. Any benefits which we may hope to derive must come from education rather than legislation.

Very complete minutes of our meeting were taken by our Secretary and they are appended to this report. I do not propose to read the complete text but will read the summary only. I do ask all of you, however, to read the discussions

at your convenience and your Committee welcomes any comments which you wish to make, preferably in writing.

Recommendations:—

(1) The Canadian Standard Form of Construction Contract, Stipulated Sum, should be completed; that is, approved by the Engineering Institute of Canada and translated into the French language. The Canadian Standard Form of Construction Contract for Cost Plus Percentage or Fixed Fee should also be revised and brought into line with the Lump Sum Contract. When these forms are published, the Canadian Construction Association should exchange new copies for outstanding old copies free of cost on request.

(2) This Committee should prepare a standard list of specification headings including all trades and designating the items which should be included under these headings. This should be done with the hope and purpose that the R.A.I.C. and E.I.C. will approve them and that all three Associations will recommend them for general use.
Going one step further, such a form might be introduced into the Engineering and Architectural faculties of our Universities across Canada as a pattern for students to follow when writing specifications.

(3) This Committee, in conjunction with the Engineers and Architects, should prepare a manual — setting forth our recommendations for the ethical practice of calling for tenders on private work. This should also be applicable in public work so far as requirements of public authorities permit. Your Committee has in mind a pamphlet similar to the one sponsored by the Associated General Contractors of America, Inc. and the American Institue of Architects.

I feel sure that both the Engineering and Architectural Associations will welcome, and give every assistance in the preparation of the two documents mentioned above.

Respectfully submitted,

E. V. Gage, *Chairman.*

Correspondence

St. Lawrence Waterway

Port Hope, Ont.

Dear Mr. Editor:

It appears from the press and radio reports that proper authority in Ottawa is now steadily working towards the construction of the International Section of the St. Lawrence Waterway to plans in general accordance with the recommendations made by the Joint Board of Engineers twenty-five years ago.

Nearly twenty years ago it was shown by Dr. Howard Barnes and others that these plans would fail to develop the natural advantages of the waterway to the best advantage of the people of Canada and that they contained shortcomings both from the engineering and from the economic standpoints. No consideration appears to have been given to the advice offered by these eminent authorities. It therefore appears prudent now to remind Canada of the great injury inflicted on her waterborne trade by a Canadian Government which accepted and followed out the advice of one of its own Commissions eighty years ago.

With that sad story in mind Canada may well question whether its Department of Transport is today a bit more competent and far seeing than was the Commission of 1871.

If any engineer today will read over the report on the Improvement of the Canals of Canada which was submitted to the Dominion Government in 1871 by a specially selected commission and will also consider that report in the light of what has happened over the intervening years he will probably wonder why the very able and experienced members of the commission recommended improvements to the canal system which were suitable only to its immediate needs.

The shadows of coming events were clearly showing on the wall even then but no direct reference to them was made in the report. The result was that before the first of the new canals was opened for traffic the vessels then building on the Great Lakes had become definitely too large to enter its locks — what to us today appear to have been very short sighted recommendations had the result that at one stroke all the ports and towns on Lake Ontario and along the St. Lawrence River were cut off from any direct participation in the water borne traffic on the Great Lakes. No one now would care to try to estimate what that error in judgment on the part of very able and sincere men has cost Canada in direct loss of business by diversion of traffic and in increased cost of handling such traffic as did find its way down the St. Lawrence Waterway — certainly the total cost figures over an interval of seventy-five years would approach the colossal.

Proper authority in Ottawa is now asking Canada to approve a project for creating a 27-foot waterway from Lake Ontario to Montreal. In view of past history and in view of the rate at which giant freighters to handle bulk cargoes are now being built it is fair to ask whether the official project of today will not cut off the ports on Lake Ontario and on the St. Lawrence River from the major water routes of the world nearly as effectively as the recommendations of 1871 cut them off from the traffic on the Great Lakes.

The following points apparently have been overlooked in the studies for the designs of the new works:— (1) A channel from the head of Lake St. Francis to the east end of the Isle of Orleans can readily be built with a depth of 50 feet or better and without excessive cost. Everywhere else no channel deepening is required although some minor obstructions will have to be removed in the Thousand Island section and a relatively short and heavy rock cut will have to be made at the Galops Rapids. Below Montreal the increase of depth can be most simply secured by holding the water levels up to spring elevation with the aid of a dam to be built east of the Isle of Orleans. (2) The best authority on ice formation that Canada has known, Dr. H. W. Barnes, has assured us that the river will run free from ice from Lake Ontario to Montreal if we will take the trouble to provide a regimented channel for its waters to flow in. East of Montreal, an equally great authority, Mr. T. C. Keefer, has assured us that the river can be kept open from Montreal to Quebec all winter long whenever we care to undertake the task. At this date the river channel is regularly kept open all winter long from Three Rivers to Quebec.

It may be added that no improvement would do more to aid in the maintenance of an ice free channel than the deepening of the channel itself to 50 ft. and the

building of levees to protect the channel from the entrance of drift ice formed on what Dr. Barnes describes as the lakes and wide bays. (3) The treating of the St. Lawrence and Ottawa Rivers as one water system to be governed by the use of Lake Ontario as a storage and regulating basin. This plan can be made to provide a great increase in hydro-electric power for use in the Provinces of Ontario and Quebec and will materially improve navigation conditions on the river below Montreal.

The improvements suggested above will call for the construction of great engineering works but these can be taken up at our leisure and built as we find that we have need of them. It is however very important that the final objective, namely an ice free channel with a depth of 50 feet and over, should always be kept in sight and that a programme of gathering together all necessary engineering and scientific data should be organized and placed in active operation without delay. Such studies cost but little to make but they do require to be made over extended periods of time.

So far as this writer has been able to note no statement has as yet been made by proper authority either in Ottawa or Toronto that would justify the public in concluding that these authorities have as yet realized or understood the great opportunity that they now have to serve the Canadian public on the construction of the St. Lawrence Waterway. The vision of creating the greatest and most useful inland waterway in the world does not seem to have been seen by these officers to whom the study of these great projects of improvements has been entrusted.

Two comments on the situation as it stands today might be of service.

(1) The major error in the 1871 recommendations lay in the size of the locks. They were to be and are 270 feet long, this when there were already locks 300 feet long in service at Sault Ste. Marie and a lock 500 feet long was in process of construction at the same point. It would appear to be in the path of plain common sense that the locks presently to be constructed on the waterway should be built to Panama Canal dimensions. All the other channel improvements can be made at leisure as required but canal locks can be and have been in the nature of permanent obstacles, the construction of which to limited dimensions should not be permitted. The total difference in cost between a series of five locks to 27 foot standard and a like series to 40 ft. standard will be found to be a sum that Canada can well afford to disregard and can absorb without difficulty.

(2) The Canadian public should be told by the proper authority that it would not be over difficult to build an all Canadian canal of satisfactory dimensions from the head of the Galops Rapids to Cornwall without encroaching on the lands of the United States and without requiring any international consents save and except approval by the International Joint Commission of certain limited encroachment on the present bed of the river close to the Canadian shore and also the approval by the Commission of the diversion of the Canadian share of the waters into a parallel canal extending from the head of the Galops Rapids to Cornwall.

The necessary works if constructed in accordance with this diversion plan would never be abandoned for they would provide both from the standpoints of navigation and of power development all that the official plans have to offer. These works would not interfere in any way with the carrying out of any plans that the Province of Ontario and the State of New York might hereafter develop for the construction of hydro electric power plants west of Cornwall. In such plants Ontario would have an active interest if the plan for the joint regulation of the St. Lawrence and Ottawa Rivers already referred to were carried out, for that regulation would make available much additional water for the use and benefit of Ontario. The success of such a plan for regulation would depend almost entirely on the free use of Lake Ontario as a storage and regulating basin and on the cutting of an adequate outlet for the waters of Lake Ontario at the Galops Rapids. The creation of an overriding international authority having jurisdiction over all storage basins on the whole St. Lawrence watershed would also be very desirable.

The cost of building this diversion development and power plant should closely approximate that of the present plant at Beauharnois which has been built at the sole cost of the Province of Quebec. The diversion canal would be considerably longer but by using higher water velocities which are in themselves very desirable as aiding in material measure in the elimination of ice the total amount of excavation would be much the same in the two projects.

It is very desirable that the facts set out in the above letter should be communicated to the members of the Institute for discussion and criticism.

Once they have been accepted by the profession as outlining a sound and reasonable procedure in dealing with a great national problem there is little doubt that they would very soon thereafter be accepted by the general public and especially in Ontario, as outlining a road along which it could travel in proud confidence to a most worthy objective.

J. G. G. Kerry, M.E.I.C.

Colonel By Workshop

Ottawa, Ont.

Dear Mr. Editor:—

Early in the New Year, the Women's Canadian Historical Society of Ottawa, is instituting a drive to secure funds to renovate the Colonel By Workshop by the Rideau Canal locks. The idea is to make of it a museum: Firstly, to preserve and exhibit the relics of early Bytown; Secondly, to be a fitting memorial to the city's founder, Colonel By, whose memory is not otherwise perpetuated, and Thirdly, to be a tourist attraction. Our museum should tell a continuous story of the city's development from the village of Bytown to the present beautiful City of Ottawa, capital of the Dominion.

This is a project in which all the people of Canada should have a part.

The following may be of interest:

On September 26th, 1826, Colonel By and Lord Dalhousie decided upon the route for the Rideau Canal which was to be built as a military necessity. Now, 125 years later, on the 26th of September, 1951, the workshop then built by Colonel By at the foot of the canal locks was leased by the Department of Transport to the City of Ottawa in trusteeship for the Women's Canadian Historical Society of Ottawa.

Our society was organized in 1898 for the purpose of encouraging the study of Canadian history and literature, the collection and preservation of Canadian historical records and relics, and the fostering of Canadian loyalty and patriotism. Our motto is: "Love Thou Thy Land."

When Harold Fisher was Mayor

of Ottawa, the society acquired the old Registry Building on Nicholas Street, as a museum. At that time the building was adequate to store and display the 300 articles then owned by the society. But as time went on and the society acquired more and more treasures, this building became utterly inadequate to care for the approximately 7,000 articles which had accumulated with the years. In that small building are Colonel By's desk and living room furniture, the log-book which he used when building the canal, his Bible brought from England by Mr. Stanley Lewis and many other treasures from early Bytown and Ottawa families. The lamp collection collected by Dr. Wintemberg is among the best on the Continent.

Money is needed to turn this old historic building into a Museum of which the people of Canada may be proud. $20,000 is required. More would do a better job. Will you help, with your dollars, your work and your interest, either individually or collectively?

Yours sincerely,

(Mrs. N. J.) Dorothy Slater,
President.

(Mrs. J. P.) Hilma Macmillan,
Corresponding Secretary.

News of Other Societies

The Chemical Engineering Division of the **Chemical Institute of Canada** (18 Rideau St., Ottawa 2, Canada) is holding a two-day conference in Hamilton, Ont., on Monday and Tuesday, March 3rd and 4th, 1952. Technical sessions and luncheons will be at the Royal Connaught Hotel.

On the programme are many interesting papers, four of which will form a symposium on petroleum.

The members of the Engineering Institute are cordially invited to attend all sessions.

Also announced is the 35th annual conference and exhibition of the Chemical Institute of Canada, in Montreal, June 2, 3, 4, 1952. All activities of the conference and exhibit will be at the Mount Royal Hotel.

The **Royal Architectural Institute of Canada,** and J. Roxburgh Smith, Montreal, president, recently announced the appointment of Cyril J. G. Carroll, of Ottawa, to the new post of secretary and executive assistant to the president of the R.A.I.C.

The 1952 spring meeting of the **Society for Experimental Stress Analysis** (P.O. Box 168, Cambridge 39, Mass.) will be held at the Hotel Lincoln, Indianapolis, Indiana, on May 14, 15 and 16.

Election of Dr. Daniel P. Barnard IV, research co-ordinator of Standard Oil Co. (Indiana), Chicago, Ill., as president for 1952 of the **Society of Automotive Engineers** was announced at the Society's annual business meeting at Detroit, in January.

The **American Society for Testing Materials** (1916 Race St., Philadelphia 3, Pa.) has available details of the Spring Meeting and Committee Week, March 3-7, inclusive, at the Hotel Statler, Cleveland.

The spring meeting of the **American Society of Mechanical Engineers** (29 West Thirty-ninth Street, New York 18) will be in Seattle, Washington, at the University of Washington, March 24-26, 1952.

The third international symposium on the **Chemistry of Cement** will be held in London, England, from September 15 to 20, 1952, and will be organized jointly by the Building Research Station of the Department of Scientific and Industrial Research, and the Cement and Concrete Association. Previous symposia were held at Stockholm in 1938 and at London in 1919.

Because of the specialized nature of the symposium, attendance will be by invitation only. Further particulars are available from the Division of Building Research of the National Research Council, Ottawa, Canada.

August, 1952, is announced as the date of the 4th Congress of the International Association for Bridge and Structural Engineering, at Cambridge, England.

Elections and Transfers

At the meeting of Council held at Headquarters on Saturday, January 19th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

W. A. Acton, *Ottawa.*
H. F. Arthur, *Sydney.*
K. W. Baker, *Hamilton.*
R. C. Beal, *Edmonton.*
H. Boardman, *Lindsay.*
H. E. Brooker, *Arvida.*
E. E. Goldsmith, *Montreal.*
T. M. Keogh, *Toronto.*
A. Kellersberger, *Montreal.*
F. A. Krefft, *Montreal.*
H. H. Lang, *Hamilton.*
G. L. MacDonald, *Ft. William.*
A. Martinowicz, *Montreal.*
L. W. Nelson, *Hamilton.*
M. F. O'Day, *Neepawa.*
T. M. O'Neill, *Montreal.*
D. L. Smith, *Glasgow Stn.*
J. W. Southin, *Vancouver.*
G. C. Stinson, *Montreal.*
W. E. Tyler, *Vancouver.*
C. B. Young, *Hamilton.*

Juniors:

A. S. Boettcher, *Edmonton.*
R. H. Clendining, *Calgary.*
J. Dick, *Cardston.*
G. Gagnon, *Rimouski.*
J. W. Newton, *Sarnia.*
A. Smerek, *Lethbridge.*
J. T. Sinclair, *Sarnia.*

Transferred from the class of Junior to that of Member:

M. C. Baker, *Ottawa.*
L. A. Beauchesne, *Ottawa.*
W. K. Campion, *Toronto.*
D. S. Caverly, *Toronto.*
G. H. Cook, *Three Rivers.*
G. F. S. Davis, *Toronto.*
G. Dumont, *Quebec.*
L. E. A. Gareau, *Rapide Blanc.*
H. L. Hillgartner, *Hamilton.*
J. B. Hockman, *Montreal.*
K. F. Humphrey, *Kitchener.*
K. B. Jelly, *Berlin, N.H.*
F. G. Leroux, *Montreal.*
W. D. MacDonald, *Winnipeg.*
R. MacPherson, *Grand'Mere.*
R. J. B. McNally, *Sarnia.*
W. D. Martin, *Red Rock.*
V. L. Mosher, *Creston.*
N. Mudry, *Winnipeg.*
M. Pageau, *Montreal.*
L. J. Poirier, *Montreal.*
R. W. Quirk, *Verdun.*
C. D. McKinney, *Victoriaville.*
A. St. Laurent, *Sudbury.*
S. R. Sinclair, *Edmonton.*
J. A. Tod, *Kitchener.*
P. C. Toft, *Sarnia.*
R. C. Weller, *S. Ste. Marie.*
W. H. T. Wilson, *Toronto.*

Transferred from the class of Student to that of Member:

W. F. Hughes, *Indianapolis.*

Transferred from the class of Student to that of Junior:

E. L. Ilson, *Montreal.*
A. D. Scothorn, *St. P. l'Hermite.*

The following Students were admitted:

ECOLE POLYTECHNIQUE

G. Allaire
J. C. Allard
L. Amyot
R. Beauchemin
R. Beaudry
G. R. Belhumeur
M. Bergevin
L. Bertrand
P. S. A. Bertrand
R. Blanchard
J. P. R. Boileau
A. Boucher
R. Boucher
F. Bourret
J. L. Brouillard
A. Brossard
R. Bussieres
P. Cardinal
R. Caron
J. G. Carriere
R. Charest
J. Chartrand
R. Chouinard
J. P. Cossette
G. Cousineau
R. Couture
G. Daigneault
L. Denoncourt
M. L. Desjardins
R. Deslandes
J. L. Dion
L. R. Dufour
A. Dugas
J. C. Dupras
J. Favron
L. Ferland
O. Fournuer
M. Fregeau
C. Gagne
R. Gagnon
J. D. A. Gaudette
Y. Gaudreault
C. Gaulin
L. M. Gauthier
M. Gendron
J. Gilbert
R. Gilbert
R. C. Girard
Y. Golding
E. H. S. Goldman
R. C. Granger
M. Houle
J. M. Hudon
M. Huppe
L. Jacques
G. Jolicoeur
M. Joubert
B. Juillet
P. Kopczynski
R. Labonte
A. Lachapelle
D. Laflamme
D. Lafontaine
J. P. G. Laforte
L. Laliberte
B. M. Larose
L. Laurin
J. F. C. Lefebvre
T. Lefebvre
J. Leonard
A. Levac
J. P. R. F. Longpre
M. Longpre
P. Major
J. C. P. E. Malo
P. C. Marier
J. E. Marleau
J. M. Mayrand
G. Mereille
R. Montpetit
J. Morin
M. Nault
J. H. J. C. Olivier
J. H. Ostiguy
J. G. Ouimet
C. Parent
P. A. Poulin
M. Quesnel
G. Robin
J. H. R. Routhier
P. Ryan
P. J. Samson
P. A. Sauriol
G. Sicard
Y. P. Simard
G. Trudeau
J. P. Trudeau
R. Turgeon
M. R. A. Valois
R. Vendetti
F. Wilson

QUEEN'S UNIVERSITY

R. J. Brisebois
K. W. Brown
J. R. Cosby
D. J. Cowan
R. K. Empey
D. M. Lever
L. B. MacLeod
C. R. W. MacPhail
D. G. Marshall
T. D. Ray
W. E. Shenton
J. W. Smith
J. H. Westaway
R. E. Wright

UNIVERSITY OF NEW BRUNSWICK

K. G. Brittain
J. M. L. Currie
N. E. Donahoe
E. C. Garland
E. J. Grant
A. M. Murray
E. C. Poirier
K. N. Walker

NOVA SCOTIA TECHNICAL COLLEGE

K. N. Burn
C. L. Fulton
A. C. Tingsley

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

T. P. Carew
N. Cole
A. W. Curren
N. A. Dennis
D. J. Duff
J. E. Moore
A. J. Newhook
H. D. Pitman
G. C. T. Power
A. E. Shears
A. G. Walsh
G. M. E. Walsh

ROYAL MILITARY COLLEGE

P. Cussieres
L. J. M. Lalonde
B. F. Simons

McGILL UNIVERSITY

Z. Vered
J. G. Wynne

UNIVERSITY OF TORONTO

G. Jeryn
J. C. D. Mallet-Paret
A. R. Molozzi

Headquarters Records

Each time the *Journal* or other Institute mail is dispatched we are advised of undeliverable items due to incorrect addresses. Our records staff must follow up these changes and the regular service to members suffers thereby. *Please* advise headquarters when your address or occupation changes. The form below can be completed, clipped, and mailed to headquarters in a few moments.

Please Print

Name .....
Surname Given names

Home Address ..... ☐

Employer .....

Employer's Address ..... ☐

(*Check address to be used for Institute mail.*)

Product or Service .....

Position or Title .....

Degree, Year & College .....

Advise Headquarters Promptly of Changes

Applications Through Associations

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

ALBERTA

Junior:

S. A. Milner.

Junior to Member:

W. A. McLaggan.

SASKATCHEWAN

Juniors:

D. F. Bond.
I. J. O. Korchinski.

Junior to Member:

R. G. Allen.
D. J. Anderson.
R. P. L. Daniels.
M. E. Dodds.
A. Friesen.
R. C. King.
S. K. Smith.

Student to Junior:

H. E. Dishaw.
D. L. Maguire.
D. H. Simpson.

MANITOBA

Members:

W. Abell.
E. J. W. Akins.
H. E. Beresford.
S. J. Borgford.
A. Bowman.
W. K. Broughton.
F. Crease.
W. C. Fisher.
E. W. Frehs.
R. Hugo.
G. H. Grescoe.
G. C. S. Johnston.
P. Kelly.
G. B. Lawlor.
T. Lemoine.
C. T. Lount.
A. K. MacKenzie.
J. Marowitch.
H. T. Millman.
W. L. Montgomery.
A. Murray.
L. E. Ostrander.
B. W. Parker.
J. Peacock.
H. S. Rimmington.
J. Sill.
F. M. Talbot.
D. P. Thompson.
F. L. van Allen.
N. Wolczynsky.

NOVA SCOTIA

Member:

S. J. Mazur.

Junior to Member:

G. V. Smyth.
R. C. T. Stewart.

NEW BRUNSWICK

Member:

D. E. Hiltz.

Junior to Member:

C. D. Carter.
G. H. D. Ganong.
D. H. Green.
R. A. MacDiarmid.
M. Turner.

QUEBEC

Members:

E. Henry.
J. Morgan.

Personals

News of the Personal Activities of Members of the Institute

E. G. Gurnett, M.E.I.C., of the Hydro-Electric Power Commission of Ontario at Belleville has been elected chairman of the Belleville Branch of the Institute.

Mr. Gurnett joined the H.E.P.C. in 1916 after graduating from the University of Toronto with a B.A.Sc. degree. He was with the municipal engineering department of H.E.P.C. until 1948 when he was appointed consumer service engineer in the eastern region. He was appointed regional manager of the eastern control region in 1949.

W. R. Mitchell, M.E.I.C., of the Canadian Bridge Company Limited at Walkerville, Ontario, has been elected chairman of the Border Cities Branch of the Institute.

Mr. Mitchell joined this company in 1940 as a designer, later becoming estimator and sales engineer.

In 1934, he graduated from the University of Manitoba and for three years worked with the Manitoba Bridge and Iron Works at Winnipeg, as production clerk, shop inspector and sales engineer. From 1937 to 1939 he was an estimator with the London Structural Steel Company Limited in Ontario and for a short time was a structural steel designer with Defence Industries Limited at Montreal until he joined the Canadian Bridge Company Limited.

B. A. Monkman, M.E.I.C., of the Newfoundland Light and Power Company at Saint John, Nfld., has been elected chairman of the Newfoundland Branch of the Institute.

Mr. Monkman has been operating superintendent with this company since 1950. From 1940 to 1950 he worked with Calgary Power Company in Alberta and was associated with construction of hydro developments. He was, after 1947, resident engineer of the Barrier Development of Calgary Power Company. He is a graduate of the University of Alberta where he received a degree in civil engineering in 1940.

Brigadier A. B. Connelly, C.B.E., M.E.I.C., is a member of the Department of National Defence, Canadian Military Mission to the Far East.

Brigadier Connelly was previously area commander at Regina. He was commander and chief engineer of the Northwest Highway System from 1948 to 1950.

He graduated with honours from the R.M.C. in 1931, and in civil engineering from McGill University in 1933. He was stationed by the army in Winnipeg for two years as a works officer at M.D. 10. He was assigned to courses with the Royal Engineers in England in 1935 and on his return was stationed at Halifax, N.S., and became deputy Adjutant General at Ottawa.

During World War II he served in various capacities throughout the hostilities. Amongst these might be mentioned that he was C.R.E., I Canadian Division in 1941-42, and of IV Canadian Armoured Division in 1942-1943. He was appointed chief engineer I Canadian Corps in 1943, and served in this capacity in England and Italy. He filled various administrative appointments overseas from 1944-1948.

J. W. Graeb, M.E.I.C., of Imperial Oil Limited has been elected chairman of the Sarnia Branch of the Institute.

Mr. Graeb is a graduate of the University of Toronto where he received a B.A.Sc. degree in chemical engineering in 1939. After graduation he worked for three years with the Spruce Falls Power and Paper Company at Kapushing, Ont. He joined the St. Clair Processing Corporation Ltd. at Sarnia in 1943 as instrument foreman becoming instrument engineer in 1945. Since 1946 he has been instrument engineer with the Imperial Oil Limited, at Sarnia.

J. W. Graeb, M.E.I.C.

J. A. MacArthur, M.E.I.C., has been appointed chief engineer with the Brompton Pulp and Paper Company Limited at Montreal, Que.

Mr. MacArthur was born in Glasgow, Scotland and was educated at Ayr Academy in Scotland. He graduated from the University of Glasgow in 1924 and spent two years with Macfarlane Engineering Company and three years as a lecturer in engineering at the Plymouth and Davenport Technical College.

He came to Canada in 1929 and worked for the Abitibi Power and Paper Company Limited, at Fort William, Ont. He has had varied experience with several chemical and engineering companies in Quebec and between the years 1942 and 1944 he was associated with shipbuilding work.

Since 1944 he has been associated successively with Sherbrooke Machineries Limited at Sherbrooke, Que.; with Longlac Pulp and Paper Co. Ltd., Toronto, and with Stadler Hurter and Co., Montreal.

Association of Professional Engineers of Ontario Elections

O. D. Johnston, M.E.I.C., was elected the president of the Association of Professional Engineers of Ontario, at the recent annual meeting of the Association. (See Month to Month Section.)

Mr. Johnston is president of Gooderham & Worts Limited of Toronto.

He served in the Canadian Expeditionary Force in World War I, before attending University. On graduation from the University of Toronto in chemical engineering in 1923, he was engaged in engineering and sales work and in 1937 he became associated with Gooderham & Worts Ltd., as manager of the industrial division. He was appointed vice-president of the company in 1941, and president in 1948.

Mr. Johnston represents the Association on the Senate of the University of Toronto, and he has served on the Council of A.P.E.O. since 1948.

J. Herbert Smith, M.E.I.C., is first vice-president of the Association of Professional Engineers of Ontario. He is the manager of the apparatus division, Toronto District Office of the Canadian General Electric Co. Ltd., Toronto.

Mr. Smith will be serving on the Council of A.P.E.O. for his seventh year. Active on many committees, his work in public relations has been most valuable.

Mr. Smith received B.Sc. and M.Sc. degrees in electrical engineering from the University of New Brunswick in 1932 and 1942, respectively. He followed C.G.E.'s test course in 1932-34, working for the Company thereafter in engineering design, commercial engineering work, field sales and application work. In 1945 he was appointed manager of the supply division of the Toronto district. He received the appointment to his present position in 1948.

Professor W. L. Sagar, M.E.I.C., was elected second vice-president of the Association of Professional Engineers of Ontario.

Professor Sagar is associate professor of civil engineering at the University of Toronto. He is also well known in the consulting field. He is a graduate

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of Toronto, and holds the professional degree of C.E.

Prof. Sagar is a veteran of two World Wars. During World War II he served overseas with the Royal Electrical and Mechanical Engineers as a workshop commander in the rank of lieutenant-colonel. Following his return to the University after the war, he took over command of the University of Toronto C.O.T.C. from which he retired only recently.

He has been on the Council of A.P.E.O. for 4 years and has been an active member of committees.

M. A. Montgomery, M.E.I.C., sales manager of Canadian Blower and Forge Company Limited, Kitchener, has been appointed to the firm's Board of Directors.

A graduate of the University of Saskatchewan in mechanical engineering, Mr. Montgomery joined the company's sales staff in 1937. He is an active member of the Association of Professional Engineers of Ontario and was the first chairman of the Kitchener Branch of the Engineering Institute of Canada.

R. M. Robertson, M.E.I.C., has been appointed assistant chief engineer of the Dominion Bridge Company, Limited.

Formerly, Mr. Robertson was a designing engineer. He joined the Company in 1909 as a junior draughtsman,

R. M. Robertson, M.E.I.C.

entering McGill University in 1913. His studies were interrupted from 1916 to 1919 when he served with the Canadian Engineers, being demobilized with the rank of captain. He continued his studies at McGill University after the war, graduating in 1920 as B.Sc., in which year he joined the bridge department of the Canadian Pacific Railway. In 1924 he returned to Dominion Bridge Company in the structural design department and was appointed designing engineer, Eastern Division, in 1948.

He is a member of the Corporation of Professional Engineers of the Province of Quebec; he is also a member of several technical committees of the Canadian Standards Association.

D. B. Armstrong, M.E.I.C., has been appointed chief engineer, Eastern Division, of the Dominion Bridge Company Limited.

Formerly, Mr. Armstrong was assistant chief engineer. He commenced his long career with the Dominion Bridge

D. B. Armstrong, M.E.I.C.

Company in 1909 as a junior draughtsman. Three years later he started his studies in civil engineering at McGill University which were interrupted in 1915 by a period of service with the Canadian Engineers; he left the army with the rank of captain in 1919.

On his return to civil life he returned to the Dominion Bridge Company as a designer and subsequently held the positions of designing engineer and assistant chief engineer of the Eastern Division. He is a member of the Corporation of Professional Engineers of the Province of Quebec, of the Canadian Standards Association and other technical bodies.

P. G. A. Brault, M.E.I.C., has been appointed designing engineer, Eastern Division of the Dominion Bridge Company, Limited.

Formerly, he was assistant to the designing engineer. He graduated from McGill University in 1921 and after varied experience with several steel fabricating companies, he joined the Dominion Bridge Company as a draughtsman in 1926. From 1931 to 1942 he was active in the structural design department of the company and in the latter year joined United Shipyards Limited for the purpose of designing launching arrangements for cargo and other vessels being built at that time in Montreal.

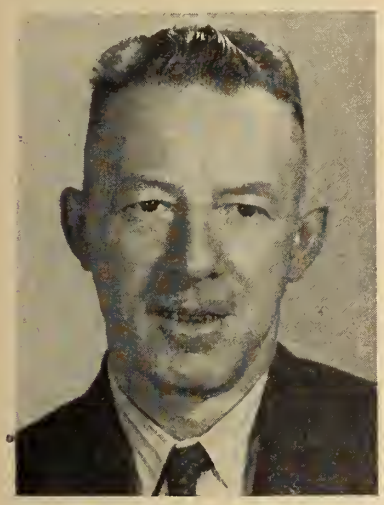
After World War II he returned to

P. G. A. Brault, M.E.I.C.

the structural design department as assistant to the designing engineer. Mr. Brault is a member of the Corporation of Professional Engineers of the Province of Quebec.

P. S. Barratt, M.E.I.C., has been appointed to the position of Superintendent Engineering Department, Kimberly Operations, by the Consolidated Mining and Smelting Company of Canada Limited.

Mr. Barratt attended the University of British Columbia, graduating in 1932 with his B.A.Sc. degree in civil engineering. During the following four years, he served with two firms of consulting engineers in mining and hydro-electric power fields. From 1935 until 1939, Mr. Barratt was employed with the Kelowna Exploration Company Limited, at Hedley, B.C. and in the following year, was engaged in engineering design at Port



P. S. Barratt, M.E.I.C.

Alberni for Bloedel, Stewart and Welch Limited. He joined the Consolidated Mining and Smelting Company's engineering staff in 1940, serving first at Trail. In 1945 he was transferred to Kimberly as Assistant Superintendent of Construction and Maintenance. Mr. Barratt became Superintendent of Construction and Maintenance, at the Sullivan Mine in 1949, a position which he held until his new appointment.

Mr. Barratt has served as president of the Kimberly Amateur Athletic Association and the Kimberly Golf Club, and is also chairman of the Kimberly Parks Board. He is a member of Rotary, the Canadian Institute of Mining and Metallurgy and the Association of Professional Engineers of B.C.

R. Bowering, M.E.I.C., Director of the Division of Environmental Sanitation, of the B.C. Department of Health, returned to duty on the first of the year. He had been on leave of absence for fourteen months with the World Health Organization in Korea. He was the sole engineer from Canada selected as an adviser in sanitary engineering to help in the rehabilitation of the areas affected by the United Nations in Korea.

C. E. White, M.E.I.C., Property Superintendent of the Con Mine of the Consolidated Mining and Smelting Company of Canada, at Yellowknife, Northwest Territories, has been appointed District Superintendent of Mines, North Central

"The Trade Fair helped us grow —we'll be back in '52"

says **P. Cadrin,** Manager,
Metalite Company Ltd., Cap-de-la-Madeleine, P.Q.

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CANADA'S OUTSTANDING INTERNATIONAL BUSINESS EVENT OF THE YEAR

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District. Mr. White, whose new position became effective at the first of the year, will now be in charge of all mining operations in the North Central District, having as his major responsibilities the Con Mine and the development of the Pine Point property.

Mr. White was born at Meriden, Connecticut. He received his B.Sc. degree in mining engineering in 1927 at the University of Alberta, following which he joined Cominco, serving as an assayer at Kimberly. Two years later he transferred to the mines staff, working in various parts of B.C. and Eastern Canada until 1936. During the next five years he held supervisory posts with the company's exploration department in Eastern Canada. In 1941 he joined the Canadian Army. For his work in laying the oil supply pipeline across the English Channel to France for the Normandy invasion, Major White was awarded the M.B.E. He rejoined Cominco following his war service in 1946, was appointed Superintendent of the Con Property at Yellowknife.

Mr. White has been active in Red Cross work and the Yellowknife Board of Trade. He is a member of the Canadian Institute of Mining and Metallurgy. He served as member of the Yellowknife Administrative District Council and as school trustee for several years.

J. A. Harm, M.E.I.C., is working with H. G. Acres and Company at Niagara Falls, Ont.

Mr. Harm was previously a design engineer with L. Y. McIntosh and Associates at Port Arthur, Ont.

He received a diploma in engineering from the Technical College of Munich, Germany, in 1946.

T. H. Fenner, M.E.I.C., Manager of the Engineering Department of The General Accident Assurance Company of Canada, retired at the end of 1951.

Joining G.A. in 1922, during his time in office he built the engineering income of the company to the top rank among multiple-line companies.

At his retirement dinner on December 28th, 1951, colleagues came from as far west as B.C. and east from Montreal to wish "The Chief" an easy time "Ashore".

He left his native Liverpool in the early part of the century. He was chairman of the Boiler and Electrical Underwriters' Association, wrote two courses in engineering, one for Shaw's Schools, the other for the Insurance Institute of Ontario. At one time he edited a MacLean-Hunter publication and was Associate Editor of the Company's General Review.

V. E. Harisay, M.E.I.C.

V. E. Harisay, M.E.I.C., has been recently appointed project engineer of the Howard Smith Paper Mills Limited. He graduated with a B.A.Sc. degree in mechanical engineering from the University of Budapest, Hungary.

H. W. Klassen, M.E.I.C., who was office manager of Phillips, Stewart and Phillips, at Saskatoon, Sask., has joined Angus, Butler and Associates Limited at Edmonton, Alberta.

Mr. Klassen graduated from the University of Saskatchewan in mechanical engineering in 1944. After service in the R.C.E.M.E., he was for a time an instructor and demonstrator at the University of Saskatchewan.

S. H. Clarke, M.E.I.C., is working for the British Columbia Power Commission in the engineering department, at Victoria, B.C.

Since 1946, Mr. Clarke had been with Bepco, Canada, Limited, in Montreal, Que.

H. Romans, M.E.I.C., is an electrical engineer with Aluminium Laboratories Limited, at Montreal.

Previously, Mr. Romans was working on the design of switchboards for Bepco, Canada, Limited at Montreal, Que. He graduated in electrical engineering from the University of Latvia in 1942.

F. R. Thompson, Jr.E.I.C., is a mechanical engineer with the Kilborn Engineering Company Limited in Toronto.

Mr. Thompson was detail engineer with Mathew's Conveyor Company Lim-

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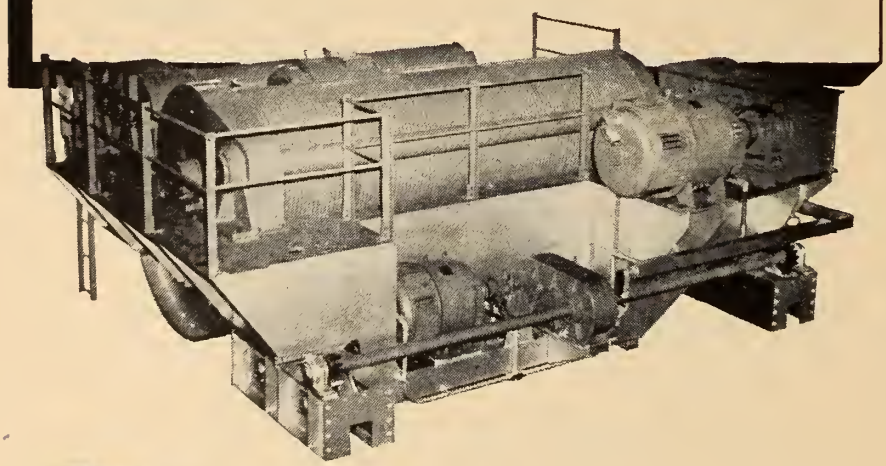

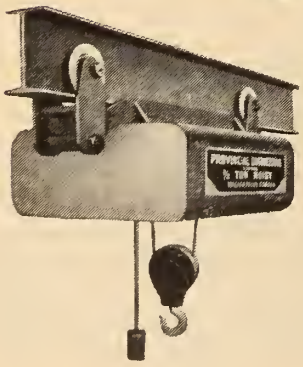

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ited from 1946 to 1949 after which he was a designer engineer for Cockshutt Plow Co. Ltd., at Brantford, Ont. He graduated from the University of Saskatchewan in 1946 in mechanical engineering.

R. J. Ruska, Jr.E.I.C., is a senior domestic engineer with Canadian Comstock Company at St. Catharines, Ont.

Mr. Ruska graduated from the University of Saskatchewan in mechanical engineering in 1949, and joined the Canadian Comstock Company in 1951.

D. A. Matheson, Jr.E.I.C., is employed with Canadian Westinghouse Company Limited, in Hamilton, Ont.

Mr. Matheson graduated in electrical engineering from the University of New Brunswick in 1949 and since 1950 had been with the Department of National Defence at Ottawa, Ont.

E. H. Hawley, Jr.E.I.C., is with Picker X-Ray of Canada Limited, at Regina, Sask.

Mr. Hawley graduated in electrical engineering from the University of Manitoba in 1949.

G. A. Bernard, Jr.E.I.C., is employed by The Kilborn Engineering Company Limited in Toronto.

Mr. Bernard graduated in civil engineering from the University of Saskatchewan in 1949 with a B.Sc. degree, and from McGill University in 1950 with a M.Eng. degree after which he worked as a designing engineer with the Dominion Bridge Company at Lachine Que.; he was also on loan to other companies in Ottawa.

Previously he had experience in survey work with the Department of Natural Resources at Regina and with the P.F.R.A. office at Moose Jaw Sask.

R. T. Tomlinson, Jr.E.I.C., is resident engineer with H. K. Black Architect and Engineer at Regina Saskatchewan.

Mr. Tomlinson graduated in civil engineering in 1950 from the University of Saskatchewan and worked for a time as assistant engineer for the Waterworks Department of the City of Regina, Saskatchewan.

F. S. Miller, Jr.E.I.C., is now employed by the Aluminum Company of Canada Limited.

Mr. Miller graduated from McGill University in chemical engineering in 1949 and has worked as research engineer with Rubberset Company Limited, at Gravenhurst Ont.

C. C. Taylor, Jr.E.I.C., has been transferred by the Hydro-Electric Power Commission of Ontario from Fraserdale, Ont., to North Bay, and holds the position of assistant to the operations engineer in the Ontario Hydro's Northeastern Region.

Mr. Taylor joined the H.E.P.C. as junior engineer in 1949, after graduating in electrical engineering from the University of British Columbia in 1948.

H. A. Templeton, Jr.E.I.C., has joined the engineering department of Cockshutt Farm Equipment Limited at Brantford, Ontario. He was previously with W. C. Wood and Company at Guelph, Ont.

Mr. Templeton graduated in agricultural engineering from the University of Saskatchewan in 1950.

J. C. Boughton, Jr.E.I.C., is a captain in the R.C.E.M.E. stationed at the Department of National Defence Army Headquarters in Ottawa, Ontario.

Capt. Boughton attended the R.C.E.M.E. school at Kingston, Ont., after graduating in mechanical engineering from the University of Saskatchewan in 1948.

Lieut. L. R. Wagener, R.C.N., Jr.E.I.C., is a staff officer (air electronics) with the Electrical Engineer-in-Chief in the Department of National Defence, Naval Headquarters at Ottawa, Ontario.

B. F. Sworder, S.E.I.C. (University of Saskatchewan, civil engineering, 1951), is working in the engineering department of the City of Hamilton, Ont.

J. R. Hosack, S.E.I.C. (University of Toronto, mechanical engineering, 1951), has joined the engineering department of McKay Company at Youngstown, Ohio.

H. A. Dare, S.E.I.C. (University of British Columbia, civil engineering, 1951), is on a training course of the Aluminum Company of Canada, at Montreal.

I. H. Stasiulis, S.E.I.C. (University of Toronto, civil engineering, 1951), is a draughtsman with the Dominion Bridge Company Limited at Toronto, Ont.

L. G. Guglielmin, S.E.I.C. (University of British Columbia, metallurgical engineering, 1951), has joined the Britannia Mining and Smelting Company Limited, at Britannia Beach in British Columbia. Mr. Guglielmin was previously with the International Nickel Company at Copper Cliff, Ontario.

R. W. Goldie, S.E.I.C. (McGill University, civil engineering, 1951), has been appointed assistant general superintendent with the general contractors, Richard and B. A. Ryan Limited, in Montreal.

Visitors to Headquarters

J. M. Bennet, Jr.E.I.C., Colbinstown, Co. Kildare, Ireland, January 4, 1952.

R. E. Tweeddale, M.E.I.C., Fredericton, New Brunswick, January 10, 1952.

A. C. Macnab, M.E.I.C., Hespeler, Ont., January 10, 1952.

R. M. Richardson, M.E.I.C., Saint John, New Brunswick, January 10, 1952.

W. R. Stickney, M.E.I.C., Toronto, Ont., January 17, 1952.

V. A. McKillop, M.E.I.C., London, Ont., January 19, 1952.

A. B. Merlin, London, Ont., January 19, 1952.

J. S. Busay, Quebec City, January 19, 1952.

Obituaries

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

Francis T. Peacock, M.E.I.C., founder and chairman of Peacock Brothers Limited, died suddenly Saturday, January 12, 1952.

Born in Birmingham, England, in 1867, Mr. Peacock was a brilliant student, winning a number of prizes for scholastic achievement. He began his first job at the age of 15 with the Ordnance Survey Office in Derby. Later he apprenticed at Walker Brothers (Wigan) Limited. While there, he attended night courses at the Wigan Mining and Mechanical School where he was awarded the gold medal as best student of the year.

At the age of 21, he sailed for the United States, where he associated himself with the steel industry, working with Carnegie Steel Corporation, Maryland Steel Company, Bethlehem Steel Corporation and the Otis Steel Company.

In 1897 Mr. Peacock began his business career in Montreal as a mechanical engineering consultant and a few years later took his brother, F. A. Peacock, into partnership with him. An agency business was developed for the sale of mechanical equipment and, later, manufacturing facilities were added. In 1919 the partnership was incorporated to a

Francis T. Peacock, M.E.I.C.

limited company with a Dominion charter.

Closely identified with the naval program in World Wars I and II and with extensive British and American connections, the company of engineers and manufacturers, under Mr. Peacock's leadership, became a nation-wide organization with offices and warehouses across the country serving almost every major Canadian industry.

Though the engineering profession was Mr. Peacock's chief interest, he was closely associated with the cultural life of Montreal and was well-known in art, literary and musical circles.

He was a life member of the Engineering Institute of Canada, having joined it in 1905. He was a member of the Mechanics Institute, a charter member of the Engineers Club of Montreal, a member of the St. James Literary Society, a life member of the Montreal Amateur Athletic Association, a member of Beaconsfield Golf Club and of the Seigniory Club.

Dr. W. W. Colpitts, M.E.I.C., distinguished consulting engineer and senior partner of the firm of Coverdale and Colpitts of Wall Street, New York, U.S.A., died at his home in New Jersey on December 23, 1951, after a long illness.

Dr. Colpitts was born in Moncton, New Brunswick, and graduated from McGill University with a B.Sc. degree in 1899. During each year of his course, he was winner of the British Association Medal. He received from McGill University the degree of master of science in 1901, and in 1921 was awarded the honorary degree of Doctor of Laws. In 1946 he was appointed a Governor of McGill University.

He commenced his long career as an office boy in the engineering department of the old Intercolonial Railway of Canada, subsequently working as a draughtsman and as an instrumentman on surveys before entering college. Immediately on graduation he was appointed chief clerk to Sir Thomas Shaughnessy, then president of the Canadian Pacific Railways, and after serving several months in this capacity was assigned to the construction department.

He went to the United States in 1901 as assistant chief engineer of the Kansas City Mexico and Orient Railway which was then under construction. He was elected chief engineer in 1909. During this period he became a pioneer in the use of reinforced concrete in the United States and wrote one of his earliest textbooks on the design of reinforced structure for railways.

In 1913, he joined the late W. H. Coverdale in consulting engineering practice in New York City, thus founding the partnership of Coverdale and Colpitts.

During the period of his association with the firm, Dr. Colpitts was responsible for the carrying out of numerous important engagements related to the management, reorganization and financing of railway properties, including the reorganization of the Missouri-Kansas-Texas, the Pere Marquette, Chicago, Milwaukee, St. Paul and Pacific, and others.

His studies included one for the unification of the Nickel Plate and a study of the operations of the Mexican National Railways for the Bondholder's Committee.

From 1938 to 1943 he was chairman of the reorganization committee of the Minneapolis and St. Louis Railroad and acted for Coverdale and Colpitts as reorganization manager.

At the time of his death he was a director of the Budd Company, Carriers and General Corporation. The Celotex Corporation and Pepsi-Cola Company. At various times in the past he had served for a number of years as director of the Chicago, Milwaukee, St. Paul and Pacific Railroad, Pere Marquette Railway, Seaboard and Air Line Railway, Autocar Company, Pierce Petroleum Corporation, Bullock Fund Limited, Nation-Wide Securities Company, Central National Corporation, and others.

Dr. Colpitts joined the Institute as a Student Member in 1897, became an Associate Member in 1899 and Member in 1905, attaining his life membership in 1947. He was also a member of the American Society of Civil Engineers, American Railway Engineering Association and a member and past president of the American Institute of Consulting Engineers.

G. A. McCubbin, M.E.I.C., of Chatham, Ontario, died at his home on November 25, 1951.

He was born at Burford, Ont., in 1869 and studied honor mathematics at Toronto University for a time. In 1895 he was admitted to practice as Ontario Land Surveyor and was associated with Ontario Government Surveys in 1897, 1901 and 1903. Later in Chatham, Ont., he became associated with municipal engineering and drainage and highway engineering.

G. A. McCubbin, M.E.I.C.

During his long career, he was responsible for a number of the largest drainage and land reclamation schemes in the Province of Ontario and also handled numerous lesser projects. Of his drainage enterprises, the more important ones were improvement of the "Canada Company cut" at Lambton County about 1912, and the proposed improvement to the Nattawasaga River.

After practising in Chatham for many years, he entered the firm of McCubbin, Brisco and Todgham, surveyors and civil engineers, dealing with drainage, structural design and land survey. He was in active practice until the time of his death.

Before going to Chatham, he was in partnership with the late James A. Bell at St. Thomas.

Mr. McCubbin joined the Institute as an Associate Member in 1899, becoming a Member in 1919 and attained his life membership in 1947. He was also an honorary president of the Ontario Land Surveyors Association. He joined the Association of Professional Engineers in 1922.

L. A. C. Lee, M.E.I.C., chief engineer for the City of Toronto department of buildings, died in hospital in Toronto on January 7, 1952, after several months of illness.

Mr. Lee had been with the Toronto city hall since 1920 when he worked in the Architect's department. In 1924 he became chief concrete engineer in the building department.

He was born in Toronto and graduated in civil engineering from the University of Toronto with a B.A.Sc. degree in 1916. During World War I, he served overseas with the signal corps of the Canadian Engineers and held the rank of Lieutenant. On his return from army service, he was for a few months, assistant traffic engineer for the Bell Telephone Company and he worked also as a demonstrator in draughting for the Truscon Steel Company of Canada before commencing his career at the city hall.

Mr. Lee joined the Institute as a Member in 1934.

J. M. Duncan, M.E.I.C., western district engineer for L'Air Liquide Society, died at his home in Calgary on December 13, 1951.

Mr. Duncan was born in Brampton, Ontario, in 1909, and was educated in Toronto at Harboard Collegiate and at the University of Toronto from which he graduated with a B.A.Sc. degree in electrical engineering in 1935.

In 1938 he joined, as sales engineer, the Canadian Liquid Air Company, a subsidiary of L'Air Liquide Society in Montreal. In 1939 he was transferred to Head Office in Montreal and in 1941 became plant manager of the Hamilton Branch of Canadian Liquid Air, later holding the position of central district engineer. In 1944 he moved to Vancouver in the capacity of western district engineer responsible for production in all plants from Winnipeg to the West Coast.

Mr. Duncan became a Member of the Institute in 1944; he was also a member of the Association of Professional Engineers in Alberta.

W. E. Lloyd, Jr.E.I.C., died by drowning on December 12, 1951, while working for the Canadian Forest Products Company at Howe Sound, B.C.

Mr. Lloyd was born at Victoria, B.C., and was educated at Mount Douglas High School, Victoria.

He graduated from Victoria College in 1941 and from the University of British Columbia in 1946, after which he spent three years as resident engineer at Beaver Cove, Vancouver Island, for Pacific Mills Ltd. From March, 1950, he was employed by Canadian Forest Products Company. He was drowned while travelling on a tug from Port Mellon on Howe Sound.

He joined the Institute as a Student Member in 1944 becoming a Junior in 1948.

G. O. Lamb, S.E.I.C., died suddenly at Regina on November 21, 1951.

Mr. Lamb was born in Regina Saskatchewan in 1923 and received his public schooling in Regina. He graduated in mechanical engineering from the University of Manitoba in 1950 and was immediately employed by Baker Manufacturing Company in Winnipeg Man.

In 1951, he joined the refrigeration department of the International Harvester Company at Regina; following a sales and service course at Indianapolis, he became the company's refrigeration representative for southern Saskatchewan with headquarters at Regina.

Mr. Lamb joined the Institute as a student member in 1948.

Employment Service

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

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

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

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER to act as sales engineer for small manufacturer in Montreal. Recent graduate. Salary open. Apply to File No. 4155-V.

TWO 1952 GRADUATES in chemical engineering required pulp and paper manufacturing company in Eastern Townships for investigations, under direction, of specific characteristics of operating processes and equipment, and of the manufactured product. Apply to File No. 4159-V.

CIVIL

YOUNG CIVIL ENGINEER for large transportation company located in Montreal in track department. Duties include general engineering work including some design. Experience not necessary. Apply to File No. 4141V.

TWO CIVIL ENGINEERS required by large engineering and construction organization as designers in structural steel and reinforced concrete. Experience required 8 years and 2 years respectively. Salary open. Apply to File No. 4149-V.

CIVIL ENGINEER required in design office of medium sized base metal mine, situated in northern Ontario. Experience in structural and plant design necessary. Salary commensurate with qualifications. Apply giving full details of qualifications to File No. 4150-V.

ELECTRICAL

RECENT ELECTRICAL ENGINEER required by manufacturer with sales offices in Montreal for sales and service work on machine tools, precision instruments etc. Territory Kingston to Halifax. Apply to File No. 4142-V.

ELECTRICAL ENGINEER required by large communication organization in Montreal. Applicant should have 1 to 3 years experience. Apply to File No. 4143-V.

GRADUATE ELECTRICAL ENGINEER required to act as executive assistant in manufacturing organization in Toronto. Applicant should be preferably under 45 years and have had experience in manufacturing sales or utilities and have held responsible positions before. Remuneration will be substantial and will be in line with the successful candidates qualifications and experience. Apply to File No. 4145-V.

ELECTRICAL ENGINEER who has recently completed the power option course in electrical engineering from a recognized university required by paper mill in Province of Quebec. Duties would range from draughting to supervising electricians and electrical installations in the mill. Although not necessary a bilingual engineer would be preferred. Apply to File No. 4146-V.

ELECTRICAL ENGINEER, minimum 1 year experience on test course, for specification writing, comparison of tenders, supervision of factory tests, liaison with manufacturers, checking drawings. Location Toronto. Apply to File No. 4161-V.

CHIEF OF SYSTEM PLANNING required by foreign operations of Canadian company. Well qualified electrical engineer for long range planning of generating, transmission and receiver facilities, supervision of distribution; relay - protection, carrier - current, research, and standards departments, forecasting capital expenditures. 7-15 years experience. Apply to File No 4161-V.

WELL QUALIFIED ELECTRICAL ENGINEER for foreign operation of Canadian company. Planning underground distribution systems and allied substations, standardizing present practices, special studies, 7-10 years experience. Apply to File No. 4161-V.

MECHANICAL

SALES ENGINEER preferably mechanical for Toronto office of manufacturer of air handling equipment such as fans, heating coils, air conditioning units, etc., to contact consulting engineers and industry. Apply to File No. 4139-V.

SALES ENGINEER for Montreal office with some experience in heating and ventilating equipment and should be preferably mechanical engineer. Apply to File No. 4140-V.

MECHANICAL ENGINEER, age 30 to 35 years, with some experience in general plant maintenance work for plant located in Montreal. Duties include helping to supervise maintenance and installation of pumps, motors, steam boilers, refrigeration system, etc., salary open, depending on qualifications. Apply to File No. 4147-V.

MECHANICAL ENGINEER required in Montreal with experience on small assembly production lines, preferably in the electronic industry. Apply to File No. 4153-V.

MECHANICAL ENGINEER required for manufacturer of spun synthetic textile yarns at Granby, Quebec. Duties will include planning production, the maintenance of the machines, the planning and installation of new machinery and daily contact with all levels of personnel. Salary open. Apply to File No. 4156-V.

MECHANICAL ENGINEER required for foreign assignment by Canadian company. Minimum 8 years experience including several years experience on operation and maintenance of large hydro-electric plants having reaction turbines. Must be acquainted with theory of strength of materials, fatigue phenomena, and alloy steels used in turbines. Apply to File No. 4161-V.

MECHANICAL SUPERVISOR for foreign operation of Canadian company. Engineer with technical and practical training, including experience in body design, engine testing and timing, repair, testing and calibration of electrical units. Diesel - engine maintenance, knowledge of modern auto transmissions. Prefer single man, age up to 30. Apply to File No. 4161-V.

MISCELLANEOUS

UTILIZATION ENGINEER required by a Canadian natural gas company experienced in all phases of service work. The company serves 75,000 meters in a number of municipalities which are grouped in four districts. Applicants must be capable of directing district superintendents in service work, installations, inspections, training programs, etc., as well as direction of a small appliance testing laboratory and preparing installation codes, etc. Applicants should state age, qualifications, experience, references and salary expected. All applications will be treated as confidential. Apply to File No. 4144-V.

SALES ENGINEER required by manufacturer of metal working compounds, chemicals for drawing, grinding, derusting, rust preventing, metal rolling, cutting and point stripping. Territory Montreal and district. Salary and profit sharing. Experience required. Apply to File No. 4148-V.

THE PUBLIC SERVICE OF CANADA requires, 2 engineers $5,930.00-$6,580.00 and three district inspectors (one bilingual) $4,940.00-$5,580.00 (operating and car equipment). Extensive railway experience is essential for these positions. Apply to File No. 4151-V.

MECHANICAL OR CIVIL ENGINEER required by pulp and paper company in Ontario. Work consists of the design and erection of buildings, installation of machinery and equipment, also certain problems involved in mill maintenance. Apply to File No. 4152-V.

RECENT ENGINEERING graduate for Montreal office. Work consists of design and price estimating on air-conditioning and refrigeration equipment. Apply to File No. 4154-V.

CHIEF ENGINEER for oil marketing company, location Israel. Experience in design and operations of bulk plants, design of service station, operational experience in loading and routine of tank trucks. Salary open. Apply to File No. 4157-V.

ENGINEERS REQUIRED for railway work, location Israel. Line engineers, engineer for supervision and repairing railway, mechanical equipment and training personnel in this field. Engineer to establish mechanical workshop who will also be able to handle diesel engines, and also train personnel. Expert in railway traffic. Expert in railway statistics. Apply to File No. 4157-V.

INDUSTRIAL ENGINEER required by large pulp and paper manufacturing and converting company, Eastern Townships, Quebec, for studies of production methods, including plant lay-out and materials handling, wage incentives, time and motion studies, job valuation. Graduate industrial or mechanical engineering. Age 22-32. Above average skill in mathematical computation and reasoning. Interest in report writing. Previous experience not essential. Full time course of 3 months duration provided upon commencement of employment. Favourable opportunities for advancement to supervisory administrative responsibilities within technical or operating departments. Apply to File No. 4158-V.

TWO 1952 GRADUATES in industrial or mechanical engineering required by pulp and paper manufacturing company

in Eastern Townships with skill in mathematical computation and reasoning, interest in report writing. Studies of production methods, plant lay-out, materials handling, etc., wage incentives, time and motion studies, jobs evaluation, etc. Full time course of 3 months duration provided at the outset. Apply to File No. 4159-V.

TWO 1952 GRADUATES in mechanical or civil engineering required by pulp and paper manufacturing company located in Eastern Townships, with skill in draughting, interest in engineering development work, participation in studies of mechanical and structural improvements, lay-out and design through on-the-site observation and through drawing board activities. Apply to File No. 4159-V.

JUNIOR ASSISTANT PLANNER required by City of Calgary. Duties to investigate analyze and design town planning projects in the town planning department. Salary $275.00 per month. Qualifications (minimum) University graduate in civil or architecture. Some experience in town planning. Apply in writing by March 10th to personnel director. Apply to File No. 4160-V.

CHIEF FOREIGN WIRE relations to negotiate agreements with other utilities, study equipment protection, electrolysis and power interference. Prefer minimum 10 years experience in design, operation and maintenance of telephone plants. Apply to File No. 4161-V.

RATE SPECIALIST required for operation of Canadian company. Retired from public utility, consultant to set up retail rate department. Age 60-70. Alternatively an experienced engineer with rate-setting background. Apply to File No. 4161-V.

COMMERCIAL DIRECTOR for foreign operation of Canadian company. Well qualified with utility experience to direct sales promotion, tariffs, consumer research, statistics, advertising and to correlate economics data. Apply to File No. 4161-V.

MECHANICAL OR CIVIL ENGINEER, recent graduate, required by Maritime Branch of large Canadian firm, for inside sales office and contact work. Territory, Newfoundland and Maritimes. Apply to File No. 4162-V.

INDUSTRIAL ENGINEER required by large manufacturing firm in Montreal. Applicant should have experience in developing overhead and operating labour standards, time study, job evaluation, cost reduction, etc. Personality and ability to deal with people important. This company is expanding in Canada and the opening holds definite future opportunity. Man under 30 preferred. Apply to File No. 4163-V.

TWO ASSISTANT ENGINEERS required by expanding organization in Western Canada engaged in the repair of aircraft, principally for the R.C.A.F. Applicant should be graduate of a recognized engineering school and have a degree in aeronautical engineering or be familiar with aircraft through practice. His duties will be to assist in the preparation of repair schemes, distribution of technical knowledge amongst our foremen and crew chiefs, organization of various repair programmes from an engineering point of view. Apply to File No. 4164-V.

THE PUBLIC SERVICE OF CANADA

REQUIRES

for the Board of Transport Commissioners of Ottawa or such other points as may be designated

TWO ENGINEERS

$5,980 - $6,580

AND

THREE DISTRICT INSPECTORS

(one bilingual) $4,940 - $5,580

(OPERATING AND CAR EQUIPMENT)

Extensive railway experience is essential for these positions.

Details and application forms at your nearest Civil Service Commission Office. Also at National Employment Offices and Post Offices.

CHEMICAL ENGINEERS or honour degree chemists required for several positions available in the department of chemistry by university located in Ontario. Duties include assisting in the instruction in under-graduate chemistry laboratories. Conducting problems on tutorial classes, conducting research under direction. No appointments will be made prior to March 1, 1952. Starting salaries $3,270.00-$3,620.00. Apply to File No. 4165-V.

SOILS ENGINEERS experienced in soil mechanics and foundations engineering, are required by a rapidly expanding organization. Graduate soils work desirable. Location Montreal, but some travelling required. Salary open. Apply to File No. 4166-V.

AN OPENING exists for a young man with engineering training to do field work and draughting in the City Engineer's department in Western Canada. Applicants with practical experience in Municipal, Consulting, Contracting or Land Surveying work will be given preference. All applications should be made as soon as possible stating age, marital status, salary expected, and when available. Detailed particulars of educational qualifications and experience must be given in first letter. Salary will depend upon experience. Apply to File No. 4167-V.

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

CHEMICAL

CHEMICAL ENGINEERS with 2 to 4 years operating experience in the chemical industry. Successful applicants will be given a 6 months' special training period in the U.S.A. before being permanently located in central Alberta by major organic chemical industry in the production department. Apply to File No. 4075-V.

CHEMICAL ENGINEER required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

CHEMICAL ENGINEERS required for employment on technical staff of a new refinery in Western Canada. Some petroleum experience preferred but engineers with experienc in allied fields will be considered. Remuneration commensurate with qualifications and experience. Apply to File No. 4128-V.

CHEMICAL ENGINEER, required for an expanding chemical industry in Western Canada. Prefer applicants with some experience and/or interest in cost analysis, plant economics and market studies. Challenging opportunity for someone leaning towards the economic phases of business operation. Age range 25 to 35 years. Apply to File No. 4116-V.

CIVIL

EIGHTEEN CIVIL ENGINEERS required in head office, Tel Aviv, for surveying, designing and planning of roads, for construction planning and structural design, water and sewage works. Length of service, a minimum of 2 years, permanent position to begin as soon as possible. Qualifications, academic diploma or membership in a recognized professional organization with at least 2 years experience. Knowledge of Hebrew is desirable but not essential. Apply to File No. 4070-V.

TWENTY SEVEN CIVIL ENGINEERS for supervision and field work of road works, bridges, buildings, water works, sewage and other public works. Location Tel Aviv and surrounding districts. Length of service a minimum of 2 years. Qualifications academic diploma or membership in a recognized professional organization. Experience at least 2 years specialized knowledge in equipment necessary for public works. Knowledge of Hebrew desirable but not essential. Age 24 to 40 years. Apply to File No. 4070-V.

JUNIOR CIVIL ENGINEER to follow basic design of structures. An excellent opportunity to understudy highly qualified senior engineer. Mathematical aptitude essential. Location Maritime Provinces. Apply to File No. 4108-V.

CIVIL ENGINEER, to act as estimator in contractors office located in Montreal. Applicant should have 5 to 10 years experience. Apply to File No. 4114-V.

CIVIL ENGINEER for public utility in Toronto, Ontario, to act as junior location engineer. A professional engineer with at least 2 years experience on field surveys and location, to supervise surveys for overhead and underground

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Sales Engineer

An expanding Sheet Metal Fabrication Company in Southern Ontario requires an alert, experienced Sales Engineer, for the research and development of new products. He must be able to introduce practical ideas and develop them as established lines for our sales programme. An excellent opportunity for the right man.

Write full details of experience and salary expected. Apply to File No. 4168-V.

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transmission lines, inspect field construction work. Apply in writing stating age, education details of past experience and salary expected. Apply to File No. 4119-V.

CIVIL ENGINEER required by public utility in Toronto to act as assistant design engineer. A professional engineer with at least 2 years experience in transmission line design to assist on design work on transmission lines, conductor mechanics and fittings, steel and wood structures, footings, foundations, etc. Apply in writing stating age, education, details of past experience and salary expected. Apply to File No. 4119-V.

ELECTRICAL

TWO ELECTRICAL ENGINEERS, required with some experience in design and testing of electrical appliances and equipment, by specialized laboratories in Toronto. Applicant should have preferably at least two years experience in the field. Apply to File No. 4100-V.

ELECTRICAL ENGINEER, required by manufacturer in Montreal for design of and supervision of manufacture of miscellaneous electrical panels for fire alarm systems, clock systems, etc. Correspondence re details of orders for special material. Company operates on a five day week, employs just over 100 persons, has a company subsidized sickness and accident policy plan. Apply to File No. 4107-V.

ELECTRICAL ENGINEER, of 5-8 years experience in the design and installation of transmission, sub-station and control equipment commonly associated with 4 to 132KW systems. Must be qualified to take responsibility for variety of electrical construction. Location Maritime Province. Apply to File No. 4108-V.

A JUNIOR ELECTRICAL ENGINEER, to assist in design and installation of electrical switching and control equipment. Location Maritime Province. Apply to File No. 4108-V.

ELECTRICAL ENGINEER, required for the design and sale of electrical panelboards, switchgears. Applicant must be bilingual. Location Province of Quebec. Apply to File No. 4112-V.

ELECTRICAL ENGINEER with about 2 or 3 years experience in industry required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

JUNIOR ELECTRIC ENGINEER required by large organization in Montreal for inspection department of the diesel locomotive division. Apply to File No. 4132-V.

MECHANICAL

FIVE MECHANICAL or Civil engineers for design and layout of buildings and equipment for asbestos milling operations. Apply to File No. 4124-V.

MECHANICAL ENGINEER with about 2 years experience in industry required by chemical manufacturing plant in Province of Quebec. Apply to File No. 4126-V.

MECHANICAL ENGINEER required by paper company in Eastern Canada, to act as lubrication engineer. Applicant would work in close contact with plant maintenance engineers and lubrication

engineers of the supplying oil companies. Age about 30 years. Salary according to qualifications. Apply to File No. 4133-V.

MECHANICAL ENGINEER, recent graduate, required for industrial engineering department in a mill in Eastern Ontario. Will be trained in time and motion study, synthesis, work simplification, scheduling, materials handling etc. in a course lasting three months. Salary will be discussed at interview. Apply to File No. 4135-V.

MECHANICAL SUPERINTENDENT with manufacturing experience in machine shop production required by manufacturer in Province of Quebec of commercial firearms. Also required process engineer capable of taking charge of engineering process. These are permanent positions in a growing business. Apply to File No. 4138-V.

MINING

TWO MINING ENGINEERS required by large mining and manufacturing organization in the Province of Quebec to take charge of surveying work underground. Apply to File No. 4124-V.

TWO SENIOR MINING engineers required by large mining organization in Province of Quebec for underground development. Apply to File No. 4124-V.

MISCELLANEOUS

MECHANICAL AND ELECTRICAL ENGINEERS for planning and supervision of air conditioning and power plants in buildings, supervision of technical equipment for buildings and public works, planning and installing, heating and hot water systems, for cooling systems in buildings, required in Tel Aviv. Length of service a minimum of two years to begin as soon as possible. Qualifications, academic diploma or membership in a recognized professional organization with 3 to 10 years experience. Knowledge of Hebrew desirable, but not essential. Age 25 to 40 years. Apply to File No. 4070-V.

ASSISTANT MANAGER, required by progressive manufacturer for over a quarter of a century in a small town in the Province of Quebec. Applicant must have experience in office management, metal stamping and sheet metal work. Must be bilingual. Excellent opportunity for the right man to become general manager in a few years. Apply to File No. 4101-V.

CHEMIST OR CHEMICAL ENGINEER, required by public utility in Maritime Province. Work consisting of directing the control of water conditioning in the steam station, the control and conditioning of transformer and lubricating oil, and the preservation of wood poles and structures. Salary based on experience and qualification. Apply to File No. 4102-V.

TWO JUNIOR RESIDENT ENGINEERS required by public works in Newfoundland, for work on highway and bridge construction. Recent graduates or engineers graduating in 1952. The posts are permanent and pensionable on the salary scale of $2,700. to $3,800. per annum, in addition a cost of living bonus of $570. per annum for salaries below $3,100. and $480. for salaries $3,100. and over is applicable. Apply to File No. 4105-V.

YOUNG MAN WITH ENGINEERING, landscaping training required by expanding memorial Gardens Cemetery Company, based in Toronto. Knowledge of construction, drafting and costing required. Also knowledge of large scale landscaping and planting is desirable. Some travel. Excellent opportunity for right man. Apply to File No. 4106-V.

MECHANICAL OR CHEMICAL ENGINEER, required by public utility in Maritime Province familiar with high pressure steam power plants and the fundamentals of boiler water conditioning. Apply to File No. 4108-V.

CHEMICAL AND MECHANICAL ENGINEER, for instrumentation control and development in newsprint mill. Should have some pulp and paper experience. Apply to File 4109-V.

AMERICAN manufacturer of industrial pumps requires engineer to act as sales engineer. Working from Toronto Headquarters, territory would be Eastern Canada where products have already been introduced. Applicant should be recent graduate with some experience in the oil industry or pulp and paper and be preferably bilingual. Apply to File No. 4110-V.

YOUNG ENGINEER required by consulting firm in Toronto for job in Western Canada with experience primarily in water and sewer installations. Apply to File No. 4122-V.

ENGINEER TO ACT as sales engineer for old established business well known throughout Canada. Applicant should be about 30 years of age with 3 years experience in the pulp and paper industry. The location is Montreal with a certain amount of time spent visiting mills in this territory. Apply to File No. 4123-V.

FOUR 1952 GRADUATES 2 mining and 2 mechanical required by large mining organization in Province of Quebec. Apply to File No. 4124-V.

CITY PLANNER required for Vancouver, B.C., to be responsible for the development and administration of the new city planning department in conjunction with a planning board of civic officials, to initiate and conduct studies, to promote, supervise and co-ordinate the planning and technical work with particular reference to zoning and subdivision control, to assist in formulating long-term improvement programs and through the above planning board, to act as technical consultant and advisor on matters affecting the growth and physical development of the city. Qualification, University graduation in Civil engineering, architecture or related field supplemented by courses in city planning, considerable planning experience including some supervisory responsibility, successful public relations, and administrative experience in municipal government, or an equivalent combination of training and experience. Salary $7,000.00 to $9,000.00 per annum depending on qualifications. Apply to File No. 4125-V.

ASSISTANT POWER STATION superintendent required by Hydro Electric Power Commission of Ontario. Applicants should have a sound practical and technical training and not less than 10 years experience in the administration, operation and maintenance of modern high pressure turbo-generators, P.F. boilers and auxiliaries. Mechanical or electrical engineer preferred. Salary range will extend to $7,800.00 per annum depending on qualifications and experience. Apply to File No. 4127-V.

INDUSTRIAL ANALYST graduate in engineering or science wanted by large Asbestos mine in Quebec. Applicants preferred who also have some education in business administration, commerce and finance or accounting. Selected individual would be trained to appraise financial desirability of making capital and operating expenditures. Age 25-30 years preferred. Salary depends upon qualifications. Apply giving details of education, experience, marital status and salary desired to file No. 4130-V.

WELDING ENGINEER required by large organization in Montreal with practical and theoretical knowledge of modern welding processes, in addition to a general engineering training. Apply to File No. 4132-V.

ENGINEER, required by City in Ontario. Applicant must be a fully qualified engineer with experience in and capable of directing the operations of road maintenance and construction sidewalks, curb and gutters, street cleaning, snow removal and garbage collection and disposal. Experience in the operation and disposal. Experience in the operation of asphalt plants desirable. The man appointed will have complete charge of these operations together with any other duties relative to streets. Salary range $4,500.00 to $5,000.00. Apply to File No. 4134-V.

MACHINE DESIGNER with from four to five years experience preferably in automatic machines, but this is not essential, for mill situated in Eastern Ontario. This opening is in connection with the mechanizing of a large department in which many of the operations are now manual or semi-manual. Salary will be discussed at interview. Apply to File No. 4135-V.

CONSTRUCTION PERSONNEL ASSISTANT required by a company undertaking major construction programme in Eastern Canada. Duties include establishing methods of operation, directing personnel staff, selecting key non-manual personnel, engineers, purchasing agents, accountants, office managers etc. Qualifications—Canadian citizen, preferably under 30 years of age, graduate engineer with construction experience, possibly plus training in business administration. Excellent opportunity. Apply to File No. 4136-V.

THERE IS AN OPENING for an ambitious young man, who is not afraid of hard work and a challenging job in the Advertising Department of a large organization in Montreal. This man probably now has a good position, but he may desire broader scope, or change of work. He should have a minimum of 3 years advertising experience, preferably industrial, a degree in Engineering or Science desirable but not essential. Good salary and opportunities for advancement offered to properly qualified man. Apply with full details of experience, education and salary expected. Apply to File No. 4169-V.

Situations Wanted

GRADUATE CIVIL ENGINEER and land surveyor with proven ability to carry out responsibilities. Available on short

RESEARCH ENGINEER

The National Research Council Ottawa, Canada, requires immediately a young university graduate in engineering specializing in Thermodynamics, to conduct low temperature tests of mechanical equipment in cold chambers and to supervise operations of 1000 H.P. ammonia Refrigeration plant. Some experience with plant operation and test work required. Initial salary up to $4,000, depending on age, qualifications and experience. Apply by air letter giving full details to the EMPLOYMENT OFFICER, NATIONAL RESEARCH COUNCIL, SUSSEX STREET, OTTAWA, CANADA.

REQUIRED
FOR WORK AT
Montreal Office

One mechanical engineer with about ten years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc.

Three mechanical engineers, University graduates with one or more years of machine design experience.

One graduate in mechanical engineering or engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics.

One mechanical draughtsman, experienced in checking of shop drawings of machinery.

Two mechanical draughtsmen with at least three years' experience.

Apply in writing or in person to:
Manager,
C.D. Howe Company Limited,
Consulting Engineers,
1421 Atwater Avenue,
Montreal 25, Quebec.

notice, over 23 years of wide experience on 4 continents. Experience includes design layout and field supervision of: roads, dams, buildings, drainage, irrigation works. Veteran CRE and EAE, married, bilingual. Situations held in Canada: chief of survey-parties, resident engineer, abroad: as district and assistant chief engineer for over 19 years in the British, Turkish, Iraqi, government services. Apply to File No. 489-W.

MECHANICAL ENGINEER, 1950 graduate with varied experience in manufacturing, desires position in Ontario. Apply to File No. 1216-W.

MECHANICAL ENGINEER Jr.E.I.C., 1948 University of Saskatchewan graduate, 2½ years research and testing, 1 year mechanical design experience. Interested primarily in the technical side of engineering. Desires new position. Apply to File No. 1458-W.

MECHANICAL AND INDUSTRIAL ENGINEER P.Eng., M.E.I.C., bilingual, first class references, experienced in production, business administration, design, methods installation, presently employed, desires responsible position. Apply to File No. 1730-W.

CIVIL ENGINEER, B.Sc., M.E.I.C., age 42, married, with 10 years experience in construction and maintenance, including layout and supervision of water supply, sewage systems, municipal engineering, underground mining and industrial buildings. Presently employed but available on short notice. Apply to File No. 2626-W.

EXPERIENCED STRUCTURAL ENGINEER, M.E.I.C., P.Eng., Ontario, age 43, married, desires employment in Toronto area. Wide experience in structural design of industrial plants and hydro-electric structures, reinforced concrete, steel, timber. Associated previously with well known Canadian engineering companies. Apply to File No. 2964-W.

SALES ENGINEER with 20 years experience sales, management, equipment design, advertising and public relations in public utility, construction and export fields is interested in making new connection. Apply to File No. 3057-W.

PROFESSIONAL ENGINEER, M.E.I.C., Graduate McGill 1943, veteran, age 31, seeks position as resident engineer, project engineer or plant engineer. Extensive experience in construction of large industrial plants including sugar refinery, pulp mill, chemical and textile plants all across Canada. Experience also includes plant layout, design, alteration and maintenance work. Would consider alternative position as executive assistant or sales engineer. Apply to File No. 3405-W.

MECHANICAL ENGINEER, McGill 1951, S.E.I.C., S.A., age 23, single. Presently employed. Desires position with heating and ventilating firm located in Montreal. Apply to File No. 3425-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., A.M.I. Mech., E., Chartered Mechanical Engineer, 1st Class B.O.T. Certificates (Steam and Motor) 1st Class A.B. Stationary Engineer's Certificate. Management, Administration, Construction, Power Plant Operation. Desires more progressive position at Senior Executive level. Apply to File No. 3420-W.

PART TIME EMPLOYMENT graduate civil engineer, Jr.E.I.C., desires part time employment in Montreal for evenings and week-ends. Experience in reinforced concrete design, foundations, laboratory testing of concrete, steel and soils. Apply to File No. 3466-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., McGill 1949, age 26, married, presently employed by construction firm in Montreal, would offer services for part-time employment in designing, estimating, etc., related to varied fields of building construction especially reinforced concrete, steel, or timber structures and foundations. Apply to File No. 3480-W.

ENGINEER, M.E.I.C. Wide experience design, construction, operation and maintenance of plants making coal and synthesis gasses and bye products, Kraft pulp and sugar. Thorough knowledge of all classes of refractories settings and coke ovens, steel and concrete structures, piping, tanks and vessels, mechanical handling equipment, boiler plant hydraulics and associate equipment; also experience in Naval architecture and shipyard routine, age 46, married, free to travel. Available early January. Apply to File No. 3505-W.

GRADUATE ELECTRICAL ENGINEER, S.E.I.C., Manitoba 1951, married, one child, R.C.A.F. veteran, presently employed, desires to gain experience in electronic design. Willing to work for moderate salary during training period. Montreal or Toronto area preferred. Available on two weeks notice. Apply to File No. 3651-W.

EXPERIENCED BUYING ENGINEER, Higher National Certificate in mechanical engineering. Age 31, married, one child. At present employed by a large industrial organization in the U.K., intends to immigrate to Canada early in 1952 and wishes to obtain a similar post in Canada. Apply to File No. 3727-W.

CIVIL ENGINEER (British, London, England) University Graduate, age 36 with practical experience in road construction, surveying, steel structures and mainly reinforced concrete (framed structures for blocks of flats, industrial buildings, heavy foundations for power stations, steel mills and gas works), used to work on own initiative and responsibility, attending to correspondence, site meetings etc., at present leading a team of designer-detailers, draughtsmen and tracers, wishes to emigrate to Canada and desires responsible position with construction company or consulting firm. Apply to file No. 3749-V.

BRITISH ENGINEERING EXECUTIVE, D.L.C.(Hons.), Grad.I.E.E., M.Inst.B.E., seeks opening in Canada. At present chief engineer to medium sized company operating several factories and making electrical and electronic products. Also acting as manager of one of these production units. Wide experience in all phases of management and in technical supervision of laboratories and workshops. 31 years of age, single and able to travel at short notice. Apply to File No. 3755-W.

ELECTRICAL ENGINEER, Jr.E.I.C., Prof. Engineer (Que.), graduated 1944, 34 years old, married, two children. Six years of sound practice with construction crews of pole lines. Good knowledge of pole line wires and hardware, and of wiring material for buildings. Can prepare layouts, specifications, estimates. Sound practice on metering outfits, and special substations. Mathematician and author of many short cuts for calculating regulation, power loss of a line. Can work anywhere preferably in Eastern Canada for a progressive company or contractor. Apply to File No. 3783-W.

RETIRED SENIOR EXECUTIVE, M.E.I.C., requires full or part time employment. Personnel, public relations, administration, or supervision or inspection of construction. Apply to File No. 3785-W.

AMBITIOUS YOUNG MAN age 26, 3 years study in chemical engineering (1947-51) desires permanent position where hard work and initiative will lead to advancement. No location preference. Available on short notice. Apply to File No. 3786-W.

CIVIL ENGINEER, S.E.I.C., B.Eng., McGill, 1951. Age 29 years, married, one child. Veteran 5½ years R.C.N. Speak and write French. One summer machine operator on punch press, screw machine. Three summers municipal engineering in surveying, design and construction of sewerage system, watermains, streets. Presently employed in railway maintenance of way. Desires position in design and construction field or in plant engineering. Available on two weeks notice. Apply to File No. 3788-W.

CIVIL ENGINEER, DLS M.E.I.C., age 61, and too active to stay in retirement after 35 years government service, desires responsible position. Background of 37 years field engineering, and administration, surveys, highway construction and design, bridges, sewage disposal, water supply, reinforced concrete structures. Would consider position as municipal engineer with town in Ontario or Maritimes or as resident highway engineer in Ontario or Eastern Province, or office engineer with private company. Apply to File No. 3790-W.

CIVIL ENGINEER, B.Sc. (Dalhousie 1948) B.E. (N.S.T.C. '51) S.E.I.C. age 23, married, no children. Interested in hydro-electric work, design and construction of reinforced concrete, steel and timber structures. Would like to work for large company with opportunity to work into managerial or administration position. Experience includes one summer with DOSCO as junior engineer, two summers with R.C.E. studying military engineering, one summer at Churchill, Manitoba, supervising construction, six months with Dyking Board in B.C. supervising construction of reinforced concrete flood box, six months R.C.S.M.E. instructing demolition. Apply to File No. 3791-W.

CIVIL ENGINEER S.E.I.C. 1952 graduate in app. mechanical option. 1 year experience in structural drawing (reinf. conc.) and some field experience. Seeks job as designer (steel or reinforced concrete) work on buildings or preferably hydro-development. Apply to File No. 3805-W.

CONSTRUCTIONAL ENGINEER age 38, wide experience in building and civil engineering, now manager of a building firm in Switzerland, leaving for Canada in the middle of March 1952, seeks independent and responsible position as supervisor for ferro-concrete works, building and civil engineering. Apply to File No. 3806-W.

ENGINEERING AND BUSINESS — 1950 Grad., S.E.I.C., age 28, veteran, married. Desires position in sales or as assistant to sales manager on technical lines. Anxious to start at bottom, learn and climb as value to organization is established. Apply to File No. 3807-W.

EXPERIENCED MECHANICAL ENGINEER M.E.I.C., 33, married 2 children. 8 years chief engineer, widely travelled, experience in maintenance, purchasing lay-out, electrical, heat treatment, handling of men and materials, problems of wear, corrosion and fatigue. Good background of metallurgy, economics, costing, statistics. At present employed, seeks senior position requiring responsibility, methodical thinking and the ability to get on well with those above and below him. Apply to File No. 3808-W.

CHEMICAL ENGINEER, Jr.E.I.C., 1949 graduate, 31 years old, veteran, 2½ years development and production (supervisory) experience in synthetic resin manufacture. Would like position (preferably in production department) in another chemical industry. Apply to File No. 3809-W.

JUNIOR EXECUTIVE. Age 31, Bachelor of Science and Bachelor of Commerce degrees. 10 years experience in electronic industry, 3½ years paper industry, 1½ years metal valve industry Experienced in supervision, plant and equipment layout, mechanical design, expediting, production control, production methods, maintenance, plant engineering. Desires responsible position as assistant to senior executive. Apply to File No. 3810-W.

MECHANICAL ENGINEER (University Vienna, Austria) specialized in Refrigeration and Air Conditioning, experience in heating, ventilation, construction of vessels, tanks, coils, pipe lines etc., sales management, calculations and estimates, automatic control, 10 years experience in Europe and last year in Mexico. Speaks English, French, Spanish, German. Desires corresponding position. Presently located in Ontario. Apply to File No. 3811-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., B.A.Sc., Toronto 1944. Experienced in petroleum engineering development; at present employed in business administrative capacity but planning on a change; married with two children; position must guarantee to keep me up to my ears in work and give ample opportunity for advancement. Apply to File No. 3812-W.

GRADUATE CHEMICAL ENGINEER, N.S.T.C. 1950, Jr.E.I.C. Age 25, married. Employed two summers while undergraduate with large steel plant in Nova Scotia. Employed since graduation with mining company. Desire permanent position in production organization. Interested in any position where hard work and capability leads to advancement. Apply to File No. 3813-W.

PART-TIME DESIGN WORK requested. Extensive experience in designs of air cylinders actuated devices for woodworking industries. Drafting help available, mechanical drawings detailed. Apply to File No. 3815-W.

MECHANICAL ENGINEER DESIGNER, M.Sc., M.E.I.C. Wide experience in Canada and abroad, sound technical, theoretical and practical background, supervisory level. Energetic and conscientious. Desire responsible permanent position with a progressive company. Availability to be discussed. Apply to File No. 3816-W.

CIVIL ENGINEER, M.E.I.C., B.Eng. 1942 graduate, age 34, small family. Eight

years' experience in plant engineering in pulp and paper industry. Experience covers maintenance, construction, plant design. Desires position in Ontario or Western Canada — preferably in pulp and paper industry. Apply to File No. 3817-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 32, married, 6 years experience in design, construction, maintenance, administration and efficiency work in large steam power plant. Desires position either in paper industry or as a plant engineer. Apply to File No. 3823-W.

ELECTRICAL ENGINEER, 41, British, seeks employment in Canada. Toronto, Ontario, preferred. Honours diploma in electrical engineering and associate member of I.E.E. 5 years as draughtsman, 14 years as electrical and mechanical engineer in the paper and rayon industries and with the British Air Ministry. Available at two months notice. Apply to File No. 3824-W.

GRADUATE ELECTRICAL ENGINEER, Jr.E.I.C. 1950 graduate needs change. Wishes to work where he can progress in engineering. Particularly interested in power, generation or heavy industry. Experience includes mine work, summer employment in generating station, and power board. Have position with considerable administrative and supervisory responsibility, but lacking chance of advancing in chosen profession. More complete detail and references on request. Present salary over $4,000. Family man, age 28, overseas veteran. Available by summer. Apply to File No. 3825-W.

ELECTRICAL ENGINEER, M.E.I.C., graduated 1944, married, two dependents. 8 years industrial and supervisory experience, at present assistant to plant manager. Desires responsible position in production field. Experience includes both heavy electrical machinery (motors, transformers, industrial controls) and light manufacturing on a production line basis. Familiar with all phases of manufacturing particularly with labour cost analysis, modern production methods including materials handling, production control and planning and wage incentives. Apply to File No. 3826-W.

PART TIME WORK graduate electrical engineer, Jr.E.I.C., desires part time work in Montreal for evenings and week-ends. Some experience in industrial power distribution and pole line construction. Apply to File No. 3827-W.

MECHANICAL ENGINEER, B.A., B.A.Sc. (British College), Jr.E.I.C., age 26, single. Three years experience in estimating, detailing, design and selling of all classes of mechanical handling plant and centrifugal machinery in Canada and Great Britain. Desires progressive responsible position in British Isles with Canadian firm having British affiliations. Salary commensurate to Canadian scale. Apply to File No. 3828-W.

METALLURGICAL ENGINEER, Jr.E.I.C., 1948 honour graduate, married. Two years experience in technical development work on production problems, 1 year as production supervisor. Desires production or development work of a metallurgical nature. Location immaterial. Apply to File No. 3829-W.

MECHANICAL AND ELECTRICAL ENGINEER, P.Eng., Jr. A.S.H.&V.E., age 31, married. Design and supervision of installation of mechanical and electrical equipment for buildings, 3 years in contracting, ventilation and air conditioning. Last six years and presently employed with consulting engineers office on industrial and hospital design. Willing to take complete charge of project including work of junior draftsmen. Apply to File No. 3830-W.

CIVIL ENGINEER, B.Sc., University of Manitoba 1939, M.E.I.C., P.Eng., age 35, married, two children, veteran R.C.A.F., nine years experience in all phases of construction on job and office administration, plant superintendent, experience also as resident engineer and mechanical superintendent. At present superintendent of construction in complete charge of large project in the West. Desires responsible position with good future preferably with firm in Ontario. Apply to File No. 3831-W.

GRADUATE ENGINEER, London University 1950, mech/elect. (28), recent immigrant, seeks a responsible and remunerative opening, where versatility, initiative and enthusiasm would promote advancement. 7½ years experience includes: shops, radar, servo-mechanism and heat-transfer equipment, design and development, coupled with D.O. routine and sales and production liaison work. Also two years part-time lecturing in England. Would travel and learn French. Offers, preferably from Toronto, Montreal or Hamilton gratefully acknowledged. Apply to File No. 3835-W.

CIVIL ENGINEER, University of Toronto 1950, Jr.E.I.C., P.Eng. Single, age 24. Past experience in surveying and highway construction and presently employed by steel fabrication company. Desires more progressive position with structural consulting firm or industrial organization. Southern Ontario or Montreal area preferred. Apply to File No. 3836-W.

INDUSTRIAL ENGINEER, B.A.Sc., U. of M., M.A.Sc., (Industrial Organization) U. of T., Jr.E.I.C., age 25, bilingual, with 2 years experience in time and motion study, cost control and incentive plan, and production planning. Interested in working with any industry on development of time standards and new methods. Actually with a firm in Quebec but available on short notice. Apply to File No. 3837-W.

CIVIL ENGINEER Jr.E.I.C., 25, 1947 graduate, 5 years with consulting firms in structural design of a large variety of industrial buildings, power plants and other structures in reinforced concrete and structural steel. Interested in responsible position with any firm engaged in the design or construction of industrial or commercial buildings, or in hydro-electric, municipal, or similar work. Will also consider part time work. Apply to File No. 3838-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., age 30, married, ex senior officer R.C.A.F. Experience includes design, draughting, estimating, plant layout and maintenance. Interested in obtaining position as plant engineer or assistant. Apply to File No. 3839-W.

PROFESSIONAL ENGINEER recently arrived from England 8 years experience in contracting and manufacture of electrical equipment in technical and administrative positions seeks employment in Toronto preferably where intelligent hard work and initiative will lead to advancement. Details and excellent references supplied on request. Apply to File No. 3840-W.

DO YOU HAVE TROUBLE getting drawings out on schedule? If so, let us help you. Engineer draughtsmen Jr.E.I.C. in Montreal available for part time work in structural and lighting layouts, wiring diagrams, etc. Apply to File No. 3841-W.

CIVIL ENGINEER, B.Sc. (Saskatchewan 1950), S.E.I.C., age 29, married, one child. Diverse experience in construction, administration, hydraulics and hydrology. Interested in obtaining a position in a city or municipal engineers department preferably in Western Canada. Presently engaged in hydraulics and hydrologic work. Available in one month's notice. Apply to File No. 3842-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., desires part time work (evenings) in Montreal. 3 years experience in reinforced concrete design. Apply to File No. 3843-W.

EXPERIENCED CONSTRUCTION ENGINEER, B.A.Sc., P.Eng. (Ont.) desires part time work in design, draughting, quantity take-off and cost estimates of building foundations. Apply to File No. 3844-W.

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CITY OF CALGARY

Attention, Members

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

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A RADIO DESIGN ENGINEER: university graduate, preferably Master's level, with 5-10 years' practical experience in the design of electronic devices, particularly those invalving pulse techniques, used in radio wave propagatian research, measurement and communications.

Must be capable af organizing and directing technical operatians of a develapment labaratory, and af acting as a cansultant on radio engineering problems. File Na. 52-E-1.

AN INSTRUMENT ENGINEER: ta maintain, cantrol and calibrate all measuring equipment used in a radio physics ar electranics labaratory. Design or madify equipment far special measurements required by any sectian af the labaratary.

Minimum of five years' practical experience in aperation and maintenance of electronic measuring equipment. Shauld have a saund backgraund in techniques of pulse measurement. The initial appointment far this pasitian will be at a salary nat greater than $3,800 per annum. File Na. 52-E-12.

Interested applicants, who are Canadian citizens ar British subjects, may secure applicatian farms fram the Director of Research Persannel, Defence Baard, Department of National Defence, "A" Building, Ottawa. Please refer ta File No. when applying.

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MAY 7-8-9

News of the Branches

Activities of the Thirty-seven Branches of the Institute and abstracts of papers presented at their meetings

Belleville

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

Ninth Meeting, January 4

At the ninth meeting of the Belleville Branch at the Masonic Temple, January 14, the attendance was 36 and E. G. Gurnett was in the chair.

The secretary-treasurer read the minutes of the previous meeting. It was noted that A. D. Janitsch was appointed by the executive to replace S. Sillitoe on the Nominating Committee of the E.I.C.

Mr. E. G. Gurnett then introduced the speaker, Lt. Col. L. F. Grant, M.E.I.C. Col. Grant's opening remarks concerned some general information regarding the Institute. At the present time there are 37 branches of the Institute across Canada. It was pointed out by Col. Grant that the Institute is taking a very active part in the selection of European engineers for emigration to Canada. Dr. L. Austin Wright, the general secretary of the Institute, had been sent to Europe by the Canadian Government to interview some of these prospective engineers. While many of these engineers were making a success of their work in Canada, Col. Grant stressed the fact that there was heavy moral obligation on Canadian engineers to make these men good Canadians.

Col. Grant then dealt with the Institute's relations with engineering bodies in the United States, describing the organization and activities and objectives of the Engineers' Council for Professional Development. The Institute is the Canadian member of E.C.P.D.

Col. Grant pointed out that we live in a wonderful country with an unlimited future. However, he mentioned there are some problems in its rapid growth, in which the Institute with the support of every member, can provide assistance.

Col. Grant then dealt with the history of the St. Lawrence Seaway. He noted that to date the greatest difficulty has been to get the Governments of the Dominion of Canada, Ontario, the U.S.A. and the State of New York to agree on the two aspects of the problem—the power development and the seaway. Actually these two aspects are inseparable from an engineering point of view. There cannot be much argument regarding the need for the power development. Present plans call for 1,500,000 hp. to be available to Ontario and a similar amount to the State of New York.

The Great Lakes and the St. Lawrence River waterway is one of the greatest in the world. From the Lakehead to the Gulf of St. Lawrence it measures 2,300 miles in length and has 6,000,000 people in Canada and 40,000,000 people in the U.S.A. living close to its boundaries.

Col. Grant then traced the history of this waterway from the year 1700 when the first Lachine Canal 1½ ft. deep was constructed until the present time. In 1785 the first wooden locks, 2½ ft. deep and 6 ft. wide were constructed past the Cascade and Cedar Rapids by the Royal Engineers. From 1826 the Huskisson Acts of Great Britain increased colonial preference but imposed duty on U.S. lumber and grain through Canada. About this time the United States asked for free use of the St. Lawrence to the sea as a "natural right." This was refused by Great Britain but later granted as a privilege. During these years the Lachine Canal was increased in size and, in 1833, the Welland Canal was opened with locks 110 ft. by 22 ft. by 7½ ft. in depth. In 1871 a treaty was signed between the U.S.A. and Canada which provided that the U.S. should enjoy forever the right of navigation on the St. Lawrence to the sea. However, nothing in the treaty permitted the use of Canadian Canals. While this point has been raised it has never been discussed but is considered most important now that an all-Canadian development of the seaway is considered.

In 1884 the Lachine Canal was deepened to 14 ft. and at the same time a programme of enlarging all St. Lawrence Canals to 255 ft. by 45 ft. by 14 ft. was begun. This also included the Welland Canal. In 1903 this programme was completed.

In 1921 the Wooten-Bawden report on the St. Lawrence submitted by the International Waterways Commission recommended a 25 ft. channel with 30 ft. locks. In 1926 a new report was prepared enlarging on the 1921 report. About this time the power development became relatively more important and the seaway relatively less important.

In 1931 the Welland Ship Canal was opened with locks 850 ft. by 80 ft. by 30 ft. At the present time there exists a channel 30 ft. deep from Prescott west to the Lakehead and 14 ft. deep from Prescott east to the Gulf of St. Lawrence.

Col. Grant noted, in conclusion, that the construction of the Seaway would undoubtedly aid Canadian commerce and provide more and inexpensive power. He also pointed out that the E.I.C. has urged the Government of Canada to consider all the engineering aspects of the problem of constructing the development so that the final plans for the seaway will be adequate for many years.

Appreciation of the Branch was expressed by Mr. J. E. Buchan. At the conclusion of the business meeting refreshments were served.

Calgary

D. C. Jones, M.E.I.C.,
Secretary-Treasurer
F. Tempest, M.E.I.C.,
Branch News Editor

December Meeting

At an exceptionally well attended meeting on December 6, 1951, the Calgary Branch had an opportunity of listening to Mr. E. H. Davis and Mr. N. L. Reid, who described in detail the proposed subway to be installed at the Fourth Street West crossing of the Canadian Pacific Railway, Main Line, and the Fourteenth Street West bridge across the Bow River.

Mr. E. H. Davis, vice-president of the firm of Haddin, Davis and Brown, consulting engineers, and his associate, Mr. N. L. Reid, very thoroughly described, with the aid of a model and lantern slides, the details of the new subway to be built at Fourth Street West in downtown Calgary.

Work in the subway is expected to start early in the spring of 1952, and the earliest completion date will be in the summer of 1953. Elaborate provision is being made to handle storm water and prevent flooding of the subway under the most severe torrential rainfall. Mr. Reid explained that water would be drained from the lowest point of the subway into a large and deep sump, where large capacity pumps would pump it into the new 10th Avenue storm sewer. Two automatic electric pumps, each having a starting capacity of 1,500 U.S. gallons per minute are estimated to have adequate capacity. However, the 3,000 G.P.M. capacity will be increased to a possible 4,000 G.P.M. by a decrease in lift if the water level of the sump is raised. An auxiliary gasoline motor driven unit is also to be installed to operate the pumps in case of power failure.

The work on the bridge across the Bow River at Fourteenth Street West is still in a highly conjectural stage. A great deal of research work is involved in a study of expansion due to heat from a summer sun on one side of the bridge while the other side is in comparative shade.

Preliminary work has revealed a thick formation of sandstone under the gravel river bed which would provide ideal footings for piers and abutments. Much of the property at each end of the bridge is owned by the city, making it possible to utilize semi-clover leaf approaches to the bridge from existing streets and highways.

January Meeting

"Alberta can sustain a number of pulp and paper mills, if all economic factors can be met to establish such a project," A. T. Hurter, president of Stadler, Hurter and Co., Montreal, pulp and paper plant consultants, told the Engineering Institute of Canada at the meeting of January 17.

Speaking on the pulp and paper industry here in Canada, Mr. Hurter touched on Alberta's potentialities in this field.

"In this province you have a number of woods suitable for pulp production. They are hemlock, cedar, Douglas fir and spruce."

Surveys of these western woods show that they have longer fibres than eastern species, a very important factor in paper production. Mr. Hurter warned that the only thing that could hold up the development of a pulp and paper industry here was the investment cost.

"For a paper mill that would produce 500 tons of paper a day the investment would be $37,000,000. A few years ago the same plant could have been put up for $12,500,000."

Because the cost of the wood was less in this province and that strip coal and natural gas might be potential sources of power, part of this cost would be offset.

Breaking down the dollar to show where it went in paper production Mr. Hurter's figures showed the cost of wood was 45 per cent of the expense, steam and power 23 per cent, labour 14 per cent and repairs and maintenance only seven per cent.

Cornwall

John A. Sarjeant, Jr.E.I.C.,
Secretary-Treasurer

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

Smoker, January 8

Chairman B. T. Yates presided over a meeting of the Cornwall Branch on January 8, at the King George Hotel.

R. H. Wallace introduced Dr. J. B. Sterling and Dr. L. Austin Wright, both of whom gave brief addresses.

The purpose of the meeting was to acquaint the members with various Institute affairs, which covered such topics as a possible increase in fees, a proposal to hire a full time editor for the *Journal*, and enlarging the size of the field secretary's office. A lively discussion took place on these topics with Dr. Sterling and Dr. Wright answering numerous questions from the members.

Mr. D. Ross-Ross outlined the present status of the post graduate lecture course which the branch is planning to start in the near future for the younger members.

During the meeting, a presentation of a gold plated engineering pin was made to H. W. Nickerson, in appreciation of

Engineers' Ball, Hamilton

The photographs below were taken at the annual Engineers' Ball of the Hamilton Branch on November 22. The Ball was described in the Branch News Section of the January *Journal*.

From left to right: W. H. M. Laughlin, then president of the Association of Professional Engineers of Ontario, and G. L. Schneider, secretary-treasurer of the Branch; Mrs. Schneider and Mrs. Laughlin.

Vice-president of the E.I.C., C. G. R. Armstrong, presented prizes to winners of the Juniors' and Students' papers competition. Left to right: C. P. Layard, first prize winner; Mr. Armstrong; J. S. R. Beck, third prize winner; and E. T. W. Bailey, chairman of the Hamilton Branch. Mr. Don Urquhart was not present to receive the second prize.

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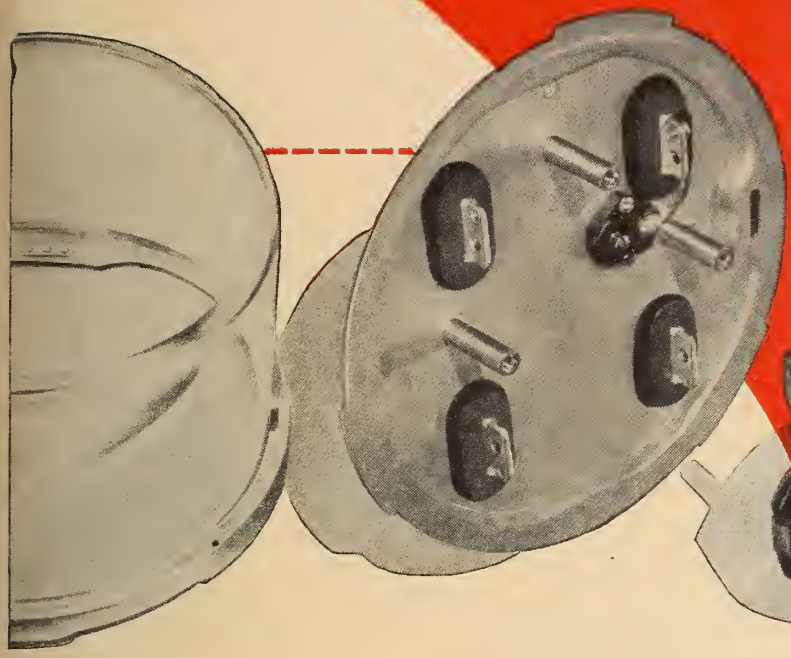

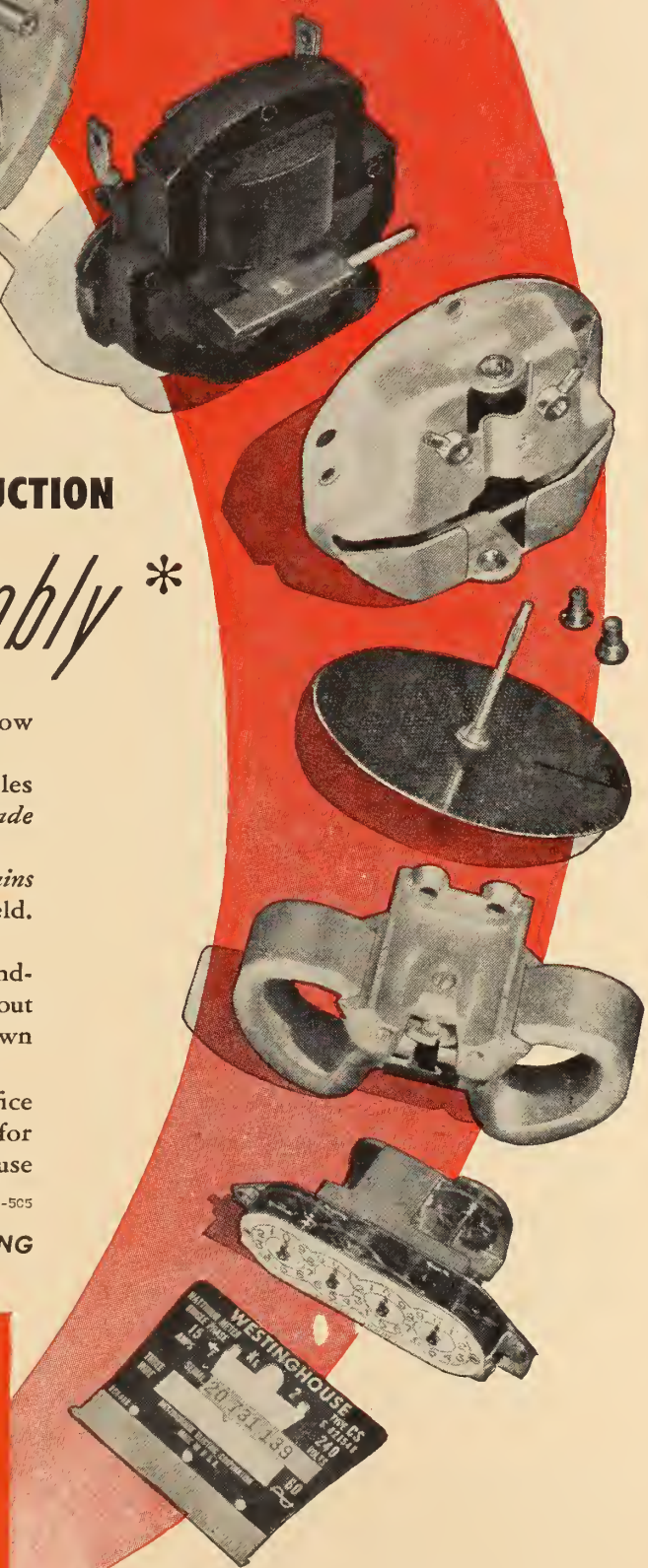

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his efforts during the past year as chairman. Mr. Donald Ross-Ross made the presentation on behalf of the branch.

Kingston

S. H. Rochester, M.E.I.C.,
Secretary-Treasurer

H. D. Forbes, Jr.E.I.C.,
Assistant-Secretary

Tour of R.C.E.M.E. Workshop

On Tuesday evening, November 20, the Kingston Branch of the Engineering Institute of Canada held their general meeting and smoker in the Officer's Mess, R.C.E.M.E., Barriefield. This meeting was held through the kind permission of Lt.-Col. J. R. Dunlop, O.B.E., M.E.I.C., Officer Commanding R.C.E.M.E. A tour of the Artisan Work Shop and Base Work Shop (Motor Vehicle) was also arranged.

After the tour members assembled in the Officer's Mess for refreshments.

December Meeting

On December 11, 1951, the Kingston Branch of the Institute held their monthly meeting in the MacKenzie Building of the Royal Military College, Kingston. Dr. Oskar Martin, of Queen's University, spoke on "Low Cost Roads."

"A low cost road has not to be a low quality road," said Dr. Martin. Maintenance costs are as important a consideration as construction costs, and costly maintenance of poor roads in some countries and localities has reached the state of emergency.

The task of the engineer is to reduce the construction cost and raise the quality of road construction. The key to the problem, in Dr. Martin's opinion, is a rational and economical application of so-called surface-active agents. Among the by-products of industry there are water-repellant substances to be found which may be applied to the need to reduce the capillary access of water to the loadbearing substructure of the road.

There is much research yet to be done on the action and reaction of surface forces. There are many substances already in use; and particular applications can call for special study.

Dr. Martin told of the study made in Sweden of the water resistance of bituminous mixtures .During these experiments 500 test stretches were laid and continuously inspected and information published. New factors have come into play meanwhile, and the complexity of the problem is still evident. This is only one of many problems awaiting the attention of engineers.

At the conclusion of the address, members and guests assembled in the Faculty Club for refreshments.

Buffet Supper and Address

The first meeting in 1952 of the Kingston Branch was held in the LaSalle Hotel at 6.00 p.m. Tuesday, January 8.

The guest speaker was Captain H. Ross Smythe of the National Research Council, Ottawa, Radar Division. His subject was "Electronic and Radar Aids to Inland Navigation." In the early development of Radar, a device was used on the Graf Zeppelin during a trip to the Arctic. It was found that by sending out sound waves, mountain and shore-line echoes could be picked up on a cathode ray tube oscillograph. This early form of radar was known as Ranging and Direction Finding. In 1934, the United Kingdom finally placed radar on their secret list. It was in the spring of 1939 that Dr. Henderson of N.R.C. went to England and returned to Canada with information about the latest developments.

During the Second World War, Canada produced 1,800 sets and by VJ Day had delivered 1,100 sets to the admiralty, leaving a balance of 700 in Canada when lend-lease ceased. It was finaly decided to rent these remaining sets to merchant shipping. These sets were satisfactory for wide ranges, but were no good for near shore use.

In 1946 the Department of Transport authorized the purchase of a boat for further development work. Consequently *Radel I* was obtained and after considerable re-conditioning to the wheelhouse was put into service. This boat permitted Canada to initiate development work on the use of radar for inland shipping. By 1949 this boat proved inadequate and a war asset Fairmile was purchased and named *Radel II*. Through continued research, merchant radar has now been improved so that it is effective for a minimum of 30 yards range.

Present development work is continuing to produce inexpensive sets.

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Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

December Meeting

At a Lethbridge Branch meeting held in the Marquis Hotel, Saturday, December 15th, 1951, P. E. Kirkpatrick presided.

Members enjoyed community singing led by George Brown and accompanied by A. L. H. Somerville, and vocal selections by C. Daniels, accompanied by Mrs. Daniels.

A film, "Rail Steel in the World Today" was shown to the meeting. This film depicted the manufacture of rail steel reinforcing bars, steel rails, structural steel, etc. in the Rail Steel Industry. Of particular interest was the prediction of the use of design stresses from 30,000 to 35,000 p.s.i. for steel reinforcing with a yield point of 65,000 p.s.i.

Moncton Branch

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

R. A. Park, M.E.I.C.,
Branch News Editor

Supper Meeting at Bathurst, N.B., Dec. 10

"Too many Canadian products are being shipped out of the provinces in the raw state" said Ira P. Macnab of Halifax, president of the Engineering Institute of Canada, speaking here at the Institute meeting which was sponsored by the Moncton Branch.

Dr. Macnab went on to say "We should see that Canada isn't robbed," and he stressed the importance of increasing the population of Canada and of working towards the establishment of a balanced economy.

One of the greatest privileges of being president of the Institute, Dr. Macnab declared, is to travel the length and breadth of Canada and to discover what a wonderful country it is.

Dr. Macnab gave a brief history of engineering in Canada and went on to tell of the progress made in the engineering fields in other countries. He pointed out that engineering is looked upon by some people as a young profession, although in reality it originated in Biblical times and some of the great engineering works of that time remain as monuments to the profession.

Dr. Macnab was very pleased to be present at the largest dinner meeting in the history of Moncton Branch, the sponsors of this meeting in Bathurst. Dr. Macnab said that the man largely responsible for the meeting was the field secretary, Col. L. F. Grant. Nearly two years ago, when Col. Grant visited Bathurst he declared "We must do something for the orphans," and he continued to impress on the branch executive the necessity of holding meetings in outlying branch territory. Dr. Macnab also paid tribute to the local Bathurst committee and to Mr. Nason, chairman of the Moncton Branch, for making the dinner meeting such a complete success.

President Macnab was introduced by W. C. Baggs of the Moncton Branch who referred to the fact that Dr. Macnab was the third Maritime president of the Institute. He remarked that this dinner meeting was the first to be held in Bathurst.

At the close of his address Dr. Macnab was thanked by B.E.U. Gagnon of the Moncton Branch.

Mr. R. L. Weldon, of Montreal, president of the Bathurst Power and Paper Co., Ltd. also spoke briefly. Mr. Weldon is a member of the finance committee of the Institute. He urged the members of the profession to study all phases of engineering.

Mr. Weldon was introduced to the gathering by Dr. L. Austin Wright, Montreal, general secretary of the Institute, who also addressed the meeting briefly.

R. L. Parsons of Moncton, councillor for the Moncton Branch, thanked Mr. Weldon.

R. C. Eddy of the Moncton Branch and the Bathurst Power and Paper Co., Ltd., also spoke briefly.

H. J. Williamson of the executive of the Moncton Branch entertained the group with a "black-face" musical act. He was accompanied by W. D. G. Stratton, vice-chairman of the Moncton Branch, as pianist.

The meeting was presided over by E. M. Nason, chairman of the Moncton Branch of the Institute.

Montreal

R. B. Wotherspoon, M.E.I.C.,
Secretary-Treasurer

Lecture Meeting, December 6

G. M. Hobart, president of Consolidated Paper Company Limited, was the speaker at a large meeting of members of the Montreal Branch of the Institute, at Headquarters, December 6, 1951.

Mr. Hobart addressed the meeting on the importance of the engineer in the pulp and paper industry. He said, "What-

fast, profitable handling of ANY material

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ever distinction this industry has, it owes to the skill of its mechanical, chemical, electrical, civil and forestry engineers, and there is no other industry in Canada which makes a more complete day to day and hour to hour use of the many crafts embraced in the engineering profession."

Mr. Hobart stated that the annual capacity of the newsprint industry alone has increased by 14 per cent during the past six years. In the past five years there have been very substantial increases in the output per man hour and there has been increased yield of pulp per cord of wood. New products and by-products have been developed and are in the market and greater use has been made of waste by-products. Trees which were formerly regarded as weeds are now used for pulp manufacture. Improved cutting methods have been devised. These improvements were attributed to the work of the engineers employed by the industry.

Mr. Hobart described the economic effects of the total annual production of approximately nine-million tons of pulp and paper.

He also outlined fundamental conditions concerning the matter of today's prices in the industry. He concluded with the remark that, "Canadian newsprint prices are the lowest in the world by a wide margin. In fact, it is being sold at a figure below that of value of its two components — ground wood and chemical pulp. For instance, in one mill 100 tons of chemical pulp yields the same profit as 160 tons of newsprint."

"Since 1946," said Mr. Hobart, "the newsprint industry has been operating at capacity. It has used this prosperity wisely." The industry has also progressed in protecting and perpetuating its forest resources; it has embarked on a comprehensive research programme; it has greatly reduced its funded debt, and has, at long last, paid its shareholders a return on their investment.

The Canadian newsprint industry can show, by actual results, an annual rate of increase in production since 1946. It is this increased production of newsprint in Canada that has made possible the post-war newspaper expansion in the United States.

Economic facts and figures were given by Mr. Hobart, and an account of the technical progress in the industry. He also described the work in forest conservation which has been going on in Quebec for many years.

In conclusion, the speaker said, "Pulp and paper is a great national industry, our dominant industry. That it may best serve the needs of Canada requires a wider understanding of its operations and problems, particularly by those who, like the engineer, hold in their hands the destiny of this great country to which we owe so much and for which we are doing so much more."

Mr. Hobart was introduced by J. A. McCrory, M.E.I.C., and thanked by J. A. Breen, M.E.I.C.

Junior Section

LEO J. HAMMERSCHMID, JT.E.I.C.
Secretary-Treasurer

Junior Section Elections

The annual general meeting of the Junior Section, Montreal Branch, was held at E.I.C. Headquarters on Monday evening, January 21.

Last year's activities were reviewed by Mr. Noiseaux, who also officiated over the elections called to fill two vacancies for committee chairmen. Competing in the elections were D. Danylkiw, Alex C. Noel and R. C. Short for English speaking committeeman, and Camille Labrecque and Jules A. Tourillon for French speaking committeeman. Mr. Tourillon and Mr. Short were elected.

Following the elections, the new chairman, R. E. J. Layton, took over the chair, and after a brief review of the planned activities for the coming year, introduced his new executive as follows: J. P. Dagenais, vice-chairman; Leo J. Hammerschmid, secretary-treasurer; and committee chairmen in addition to those newly elected: Walter T. Clark, Gaetan Ducharme, and Guy L. Blain.

During the scrutinizing of the ballots, films obtained from the Bell Telephone Company were shown. Following the close of the meeting, refreshments were served.

Newfoundland

B. E. HIGGINS, M.E.I.C.,
Secretary-Treasurer

December Meeting

The December meeting of the Newfoundland Branch was held in the Memorial University on December 10th, with the chairman, B. A. Monkman, in the chair. After a short business meeting the chairman asked Mr. C. Knight to introduce the speaker of the evening, Mr. C. H. Conroy, chief engineer with the Government of Newfoundland.

Mr. Conroy took as his subject "The Salt Velocity testing of hydraulic turbines". Basically, this is a method of ascertaining the velocity of water in a turbine flume. A concentrated salt solution is injected into the body of water passing through the flume and then, by measuring the time in seconds that it takes this saline solution to pass two fixed electrodes inserted in the flume, the velocity can be calculated. The passage of the salt solution past an electrode caused a mometary current to flow in it, the flow of current being indicated on a recording watt-meter. Mr. Conroy described in detail the apparatus used, much of which had to be improvised, and the procedure in carrying out such an experiment in which he had taken part at the power plant at Deer Lake, Newfoundland.

At the conclusion of Mr. Conroy's very excellent talk a lively discussion took place between the members on this and other methods of velocity testing and hydro-electric power plant operation in general.

A hearty vote of thanks was extended to Mr. Conroy by Mr. E. L. Baillie. After adjournment, supper was served by members of the Ladies' Auxiliary.

January Meeting

A meeting of the Newfoundland Branch of the E.I.C. was held on Monday evening, January 15th, at the Memorial University with Mr. B. A. Monkman presiding.

On the business agenda was a report from the entertainment committee that arrangements had been made and that tickets were available for a supper dance to be held at the Old Colony Club, St. John's, on February 18.

The special speaker for the evening was Mr. R. F. Martin, St. John's city engineer, who was introduced by Mr. J. Hopkins. Mr. Martin took as his subject "Sanitary Land Fill". He out-

Montreal

A photograph taken at the Montreal Branch meeting of November 15. Guest speaker was the Hon. Milton F. Gregg, whose paper appeared in the January issue of the *Journal*. Left to right: R. W. Phillips; J. B. Stirling, vice-president of the Institute; the Hon. Mr. Gregg; and E. R. Smallhorn, then chairman of the Branch.

lined the problem of garbage disposal in a modern city, the relative costs and advantages and disadvantages of the various methods. He showed how the Sanitary Land Fill method was finally decided upon for the City of St. John's. Mr. Martin illustrated his talk with a colour film showing the operation of a "Sanitary Land Fill" in a United States city and then, with some slides, showed actual operations in St. John's.

A vote of thanks to Mr. Martin was proposed by Mr. Alex Butt. After the meeting adjourned, coffee and sandwiches were served. This meeting was very well attended; about forty-five St. John's members were present. During the evening the chairman welcomed several new members to the Branch.

St. Maurice Valley

D. G. Demianiw, Jr.E.I.C.,
Secretary-Treasurer

Senior Branch

The Fall activities commenced with a golf tournament and industrial visit on September 29, 1951. The golf tournament was held jointly with the local A.I.E.E. branch at the Ki-8-Eb golf course at Trois-Rivieres. Only 12 golfers were present. The industrial visit included an inspection of the new Canadian Westinghouse plant and the new Shawinigan Water and Power sub-station; both are situated at Trois-Rivieres. Attendance for the industrial visit was 25.

Trois-Rivieres Junior Section

On October 11, 1951, the Trois-Rivieres Junior Section held its opening meeting of the 1951-52 season. New executive officers are:

Chairman — J. U. Moreau
Vice-Chairman — A. Glossman
Sec.-Treasurer — L. A. Pattison
Committeeman — L. G. Boivin

Ian MacArthur spoke on "The Sulphite Mill of the Canadian International Paper Company" while W. M. Wood outlined the layout, operating and special problems of medium and low voltage systems for supplying small factories, business and domestic establishments.

Shawinigan Falls Junior Section

Industrial visits to the Grand'Mere Knitting Co. and the Textile Weavers Ltd. at Grand'Mere and to the Cellophane Division of Canadian Industries Ltd. at Shawinigan Falls took place during the Fall months.

A stag was held at the Hotel Chateau de la Mauricie on October 14. Guest speaker on this occasion was Dr. R. L. Stevenson, medical officer at Shawinigan Chemicals Ltd. Dr. Stevenson traced the methods for the treatment of disease from the days of Louis Pasteur (19th century) to the present day. The discovery of antibiotics such as penicillin was claimed to be one of the greatest medical discoveries, since they can be used in the treatment of a wide range of diseases.

The annual formal dance was held on November 10 at the Cascade Inn.

A very interesting set of movie films covering such subjects as the Alaska Highway, the Shipshaw Power Development, Chalk River Atomic Energy Research and the Handling of Explosives was shown at the December meeting.

Vancouver

Stuart S. Lefeaux, M.E.I.C.,
Secretary-Treasurer

W. L. Inglis, M.E.I.C.,
Branch News Editor

January Meeting

The first meeting of the Vancouver Branch for 1952 was held on January 16th and was attended by some 70 members.

Announcement was made by the Chairman, Mr. S. H. de Jong, that life memberships in the Institute had been granted to Messrs. C. Hamilton and H. N. (Dutch) Macpherson.

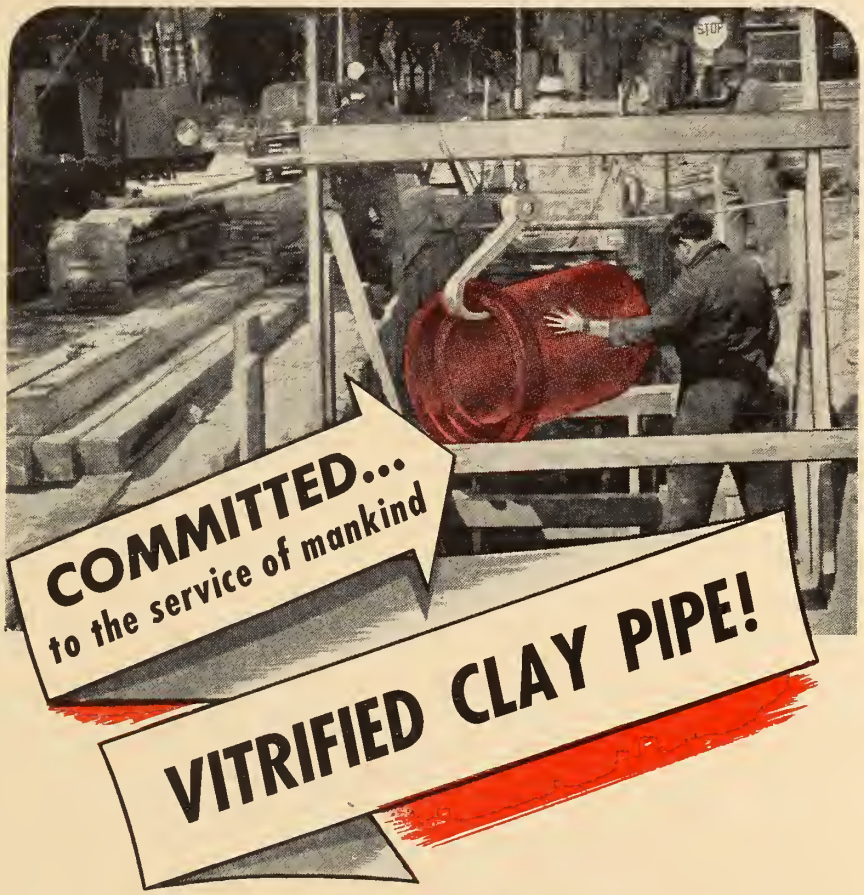
Mr. de Jong then introduced the speaker of the evening, Mr. A. H. Sager, executive assistant to chairman, Fisheries Association of B.C., who spoke on the subject "Fish and Power".

In his address Mr. Sager outlined the problem of the fish conservationists in respect to the construction of dams for power and other purposes which interfere with the habits of migratory fish and adversely affect the fishing industry.

He referred particularly to the situation in British Columbia where large scale industrial power developments are now being carried out by the B.C. Power Commission, and the Aluminum Company of Canada.

The aim of the fisheries people he said was to obtain the closest possible co-operation and integration at the planning stage among those concerned with dam projects. He pointed out that some success in this respect has been achieved in the United States but only in recent years and after considerable damage had been caused to fisheries production.

In B.C. an attempt is being made to encourage the development of power resources on streams not used to any appreciable extent for spawning. This is



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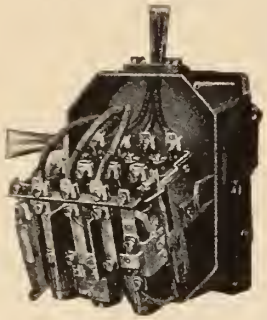

Type "SC1" Magnetic Starter.

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being done in the case of Alcan's Nechako River dam to produce 1,600,000 horse power. However as such sources become used up, the speaker explained, it will be necessary to consider other means of solution.

He mentioned the role that engineers might play in this in the design and construction of effective methods of getting the fish over dams in quantity without harm; or alternatively in the development of sources of power other than water power.

Mr. Sager emphasized the importance of the fishing industry in B.C., which had a production value of $91 million in 1951 and gave employment to over 20,000 people in 35 coastal communities.

A brief discussion period followed and the meeting concluded with a vote of thanks to the speaker.

Vancouver Island

W. A. Bowman, M.E.I.C.
Secretary-Treasurer

G. J. A. Kidd, Jr.E.I.C.,
Branch News Editor

December Meeting

On December 21, 1951, the monthly joint meeting of the Vancouver Island Branches of the E.I.C. and B.C. Engineering Society was held in the Cafeteria of the new Douglas Building of the Parliament Buildings.

Speakers for the evening were Drs. M. S. Hedley and S. S. Holland, geologists, Mineralogical Branch, B.C. Department of Mines and the subject of their talks was "A Geologist Looks at British Columbia".

The joint meeting was opened by Mr. R. E. Potter who presented the two guest speakers.

Dr. M. S. Hedley, an expert on the geology of southern B.C., gave the talk with Dr. S. S. Holland, an expert on northern B.C. Geology, showing descriptive slides and answering questions concerning the geology of the northern section of the Province.

The talk, as presented by Dr. Hedley, was a most informative non-technical description of the Province's physiography given with a geological bias.

Dr. Hedley described the various mountain ranges in B.C. and went on to say that at one time the whole of B.C. was under ice and as the ice receded the Province was glaciated as shown by the typical sweeping valleys of U-shaped outline, scalloped ridges and glacial cirques. Parts of B.C. are still covered by glaciers such as the Taku Icefields and Mt. Fairweather. Other areas such as Mt. Waddington show a decline from the continued ice-cap to that of alpine glaciation. Glaciers are streams of ice with a definite flow and can often form a complex and complicated system.

Receding glaciers leave a completely disorganized and ill-fitted drainage as around Anabeim Lake. Gradually, however, proper drainage asserts itself by downcutting of the rivers through glacial deposits. This is illustrated by the Fraser River and its incision of a plateau built up by deposited silts from the melting ice.

Not so long ago B.C. had several active volcanic areas which built up the surrounding country by lava flow. Telegraph Creek in north central B.C. was a recent centre of such activity. Mt. Edzeza in that area shows evidence of activity not more than 200 years old.

Dr. Hedley described other interesting phenomena such as the rain wash and wind erosion evident in many parts of B.C. particularly near Savanah, and the Rocky Mountain Trench, one of the unique valleys of the world.

The talk was excellently illustrated by slides, courtesy of the B.C. Department of Lands and Forests Air Survey Branch, B.C. Department of Mines and D. A. MacLean.

The talk was followed by a question period at the end of which T. A. J. Leach moved a vote of thanks.

The joint meeting was preceded by a business meeting of the E.I.C. The nominating committee gave its report and presented a slate to be voted upon at the annual E.I.C. meeting to be held in January. Mr. W. A. Bowman, the secretary-treasurer for the past two years, was voted an Honorarium and the Branch's thanks for past services. It was decided to hold the annual meeting as a dinner meeting at the Oak Bay Beach Hotel on January 18, 1952.

November Meeting

A joint meeting of the Vancouver Island Branches of the Engineering Institute of Canada and the B.C. Engineering Society was held in the Reading Room of the Provincial Library in the Parliament Buildings at 8:00 p.m. on November 16.

The guest speaker, Mr. Wm. Mackie, officer-in-charge of the Victoria City Weather Office, was introduced by Mr. Leach. The subject of Mr. Mackie's talk was "The Work of the Meteorological Service in Canada".

The Meteorological Service is a branch of the Air Services Division of the Department of Transport. However, reliable weather forecasts are important not only in aviation but also in navigation, industry, logging, construction, farming, shipping of perishable goods, fighting forest fires, snow removal, etc. Four weather forecasts are issued daily from the Victoria Weather Office and these are valid for a period of 48 hours ahead of the issuing time.

The Research and Training Division of the Service is located in Toronto. The work of this Division includes among other things the design, manufacture and repair of meteorological instruments.

Climatic data are collected by Basic Weather Services. There are some 1100 weather observing stations in Canada of which 249 are key stations. Some of the observers work on a voluntary basis. In addition to reading the various instruments such as the wind recorder, the maximum and minimum thermometer, the mercury barometer and the aneroid barometer, these observers must be able to identify the various types of clouds.

Teletype circuits are used for passing on weather information to the Stations where forecasts are prepared. Short wave radio is used in the more remote areas. A considerable amount of information is obtained from merchant ships and weather ships. Canada maintains one weather ship in the Pacific Ocean while the United States maintains four.

There are 27 stations in Canada from which observations of the upper air are

made. An instrument called the "Radioson" is carried aloft by a balloon about 6 ft. in diameter, containing hydrogen. The instrument contains a small radio transmitter and, from signals given out at intervals, temperature, humidity and pressure are obtained. A target attached to the instrument enables wind direction and speed to be plotted for the upper atmosphere by means of radar. The balloon bursts at a height of 60,000-70,000 ft. These observations are made twice daily.

Mr. Mackie showed how weather information is plotted, how weather maps are drawn and how weather forecasts are made. He explained the meaning of various terms used in meteorology. A weather front is the boundary between two different masses of air. A cold front occurs when cold air replaces warm air, while a warm front occurs when warm air replaces cold air.

There were a number of questions from the floor. A vote of thanks was proposed by Mr. G. F. Green.

This was the first joint meeting of the E.I.C. and the B.C. Engineering Society. It is proposed to hold all future ordinary meetings jointly. Name tags were distributed to all those who attended the meeting in an attempt to make the members better acquainted with one another.

Winnipeg Electrical Section Dance

The photographs below were taken at the annual dinner and dance of the Winnipeg Branch Electrical Section, November 23 last. The dance was described in the Branch News Section of the January *Journal*.

Dean G. P. R. Tallin spoke at the dinner. Left to right: Dean Tallin, E. P. Fetherstonhaugh, past president of the Institute, and L. A. Bateman, chairman of the Section.

From left to right: D. M. Stephens, Mrs. Stephens, L. A. Bateman, Mrs. Bateman, and W. D. Hurst and Mrs. Hurst.

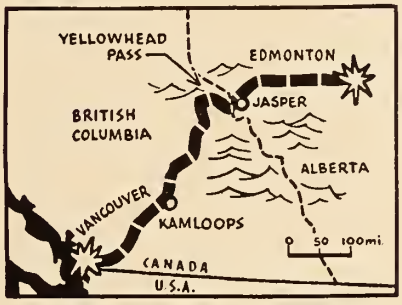
Aerial Survey

PRESSURE vs. HEIGHT

The big job of building and maintaining the 700-mile Trans Mountain Pipe Line from Edmonton to Vancouver — scheduled for completion in December, 1953 — is going to be less difficult than many people predicted. An important reason: the use of advanced surveying methods.

Movement of Alberta's crude oil westward across the Rockies raises a simple basic problem: oil flows downhill but you have to pump it uphill. And the pumps must provide enough pressure to offset both the height of the hill and friction in the pipe.

The cost of piping crude is proportional to the length of the line, the number of river crossings, the type of ground (earth, swamp, rock) that must be excavated — and the amount of pressure required to move the oil "over the hill".



Trans Mountain: The cost is proportional

Commissioned by Trans Mountain to locate a pipe line route through the Yellowhead Pass and down the North Thompson, Coquihalla and Fraser Valleys, consulting engineers Lockwood Kessler & Bartlett (Canada) Limited decided that these variables could be most efficiently assessed with the aid of aerial photography. This job — photographic coverage three miles wide along the mountain route, at a scale of 1600 feet to 1 inch — went to The Photographic Survey Corporation Limited of Toronto.

Studying the photographs stereoscopically at night and reconnoitring the ground by day, engineers were able to reduce the number of water crossings, avoid bad going, and minimize the length of the pipe line. Photogrammetric measurement of elevations enabled them to select direct routes over many hills, while avoiding altitudes that exceeded oil pressure specifications.

First photography was flown last May 31, and pipe line location completed July 12. Final staking is now being rushed to completion, and construction is due to start within a few months.

If you are interested in the application to your problems of such aerial survey techniques as photogrammetric mapping, airborne profile recording, forest inventory, aeromagnetic surveying, etc., write on company letterhead, indicating field of interest, to:

The Photographic Survey Corporation Limited

1450 O'Connor Drive, Toronto, Canada

4-52

LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Mechanical Engineers' Handbook. 5th ed. L. S. Marks, ed. Toronto, McGraw-Hill, 1951. 2,236 pp., illus., thumb indexed, $19.75.

A new edition of Marks has come by now, to be an event in the engineering world. This new fifth edition is particularly welcome, as it is the first revision since 1941.

Old habitual users of Marks may feel a pang of loss at seeing, instead of the old wine-coloured leathcrette handbook, a sturdy buckram covered text-book type of volume measuring 6″ x 9″.

The book is still thumb indexed, but in a manner which is very awkward for quick reference. Each two sections have one notch. This, in itself, seems unnecessary, specially in view of the enlarged page size of the new edition. But, the innovation which we find very annoying is that of notching at the second of the two sections combined, rather than at the first. The result: one is consulting section fifteen, so turns to notch 15/16; one opens up at section sixteen, and has to thumb one's way back, page by page, until one comes to section fifteen. We would strongly suggest that this be corrected in the next printing. And another suggestion we are prompted to make is with regard to page headings. As a new phase of a subject is introduced, it is bold-faced at the opening of the paragraph. There might be three of these to a page, but one of them is elevated to the position of a page heading, while the other two remain unrepeated in their allotted place on the page. This one finds inconsistent and at times confusing. These, however, are criticisms purely of mechanics and format.

As soon as our readers consult the new Marks, they will find the improved quality of the paper a joy to handle, and certainly more easy on the eyes. It is thicker, and slightly glossy, and the book is printed in an incomparably better type. Also slightly larger scale diagrams and figures are possible with the new larger page which is a great improvement.

The list of contributors to the fifth handbook has decreased from eighty-four to eighty-two, but the list of contents, on the other hand, has increased from thirty-one, to forty-one entries, and Symbols and Abbreviations from two hundred and forty-three to two-hundred and sixty-nine.

As one examines this volume, one finds the obvious revisions of subjects. The section on Aeronautics appears to be smaller, until one finds additional section on Aircraft Propellers and Jet Propulsion.

Increased, and entirely new treatment is given to Radiant and panel heating, Snow-melting of walks, etc., Solar energy in buildings, and Industrial ultrasonics.

A table of Utilization Factors has been added to the section on Fluorescent lighting, with additional illustrations of fixtures.

The old section on fuels and furnaces has been enlarged to three individual parts, and Power Generation has been quadrupled.

Cost accounting and Statistical Quality Control now receive their own heading in the table of contents, as do Electron tubes and Radio. And, no less than four pages are devoted to Radar, a science completely new since the 1941 edition.

The usual comprehensive index runs true to form. Altogether many of our members would find this new handbook a necessary addition to their shelves.

Might we remind you that the library copy is for REFERENCE PURPOSES only, and may not be removed from the reading room.—E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Advanced Treatise on Physical Chemistry. V. 2: The Properties of Liquids. J. R. Partington. Toronto, Longmans Green, c1951. 448 pp., illus., $9.00.

The present volume is concerned with the general physical chemistry of the liquid state. It deals with the theory of liquids, density, thermal expansion, compressibility, viscosity, thermal conductivity, surface tension, specific heat, vapour pressure, boiling point, latent heat of evaporation and the critical state. In addition to descriptions of apparatus and experimental methods, many tables are given. One outstanding feature of this work is its inclusion of a great number (literally dozens to each page) of references to the literature of the subject. It also contains many empirical or semi-empirical formulae likely to be of use to laboratory workers and to chemists and engineers engaged in large-scale work.

Canadian Woods: Their Properties and Uses. 2nd ed. Ottawa, Department of Forestry, Forest Product Laboratories, c1951. 368 pp., illus., $3.00.

Forest product laboratories have intended this reference book as an aid to more effective wood utilization in Canada. A great part of the information consists in results of the Laboratories' own investigations. Each chapter has been written to include only the most pertinent data. Excellent bibliographies at ends of chapters include only references directly related to the immediate subject-matter. A list of definitions of terms used in the lumber ndustry is given, as are also lists and tables of trade abbreviations, mechanical properties of Canadian woods, recommended safe working stresses, maximum moments of resistance, weights, safe loads, moments of inertia, etc. The book is very well illustrated with drawings, diagrams and 108 plates.

Coastal Engineering: Proceedings of First Conference. Long Beach, California. J. W. Johnson, ed. Berkeley, Council on Wave Research, 1951. 334 pp., illus., $4.50.

This symposium of 35 papers on coastal engineering, is divided into five groups: basic principles of wave motion, basic

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Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

Please give as much detail as possible when requesting information of either type.

Borrowing and Purchasing

Books, periodicals, photostats, translation, etc. may be borrowed for two weeks at a time. **A fine of 25c. per day will be charged for each day borrowed items are retained beyond this period.**

A library deposit of $5.00 at par in Montreal is required for which two items may be borrowed at one time. Books, periodicals, etc. may be ordered by members through the library. All carrying charges are payable by the individual concerned. Except in the case of library deposits, please make **no payments in advance.**

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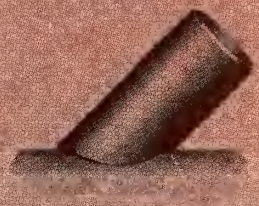
Welding Sleeve

Return Bend

Cranelap Welding Nipple

Reinforcing saddle



Shaped Nipple 45° to Header

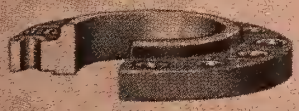
90° Elbow

45° Elbow

Concentric Reducer

Cap

Cranelap Flange with Welding Nipple



Slip-on Welding Flange

Welding Neck Flange

Welding FITTINGS and FLANGES

FOR EVERY SERVICE REQUIREMENT

ALL the advantages of one reliable source of supply are yours in Crane's complete welding line. It includes all the popular types of steel fittings—in a wide range of sizes—both Standard and Extra Strong weights—all of Crane quality throughout.

Butt-Welding Fittings are the reliable selection for all-round welding service. They reduce the welder's task to its simplest form—the making of simple circumferential butt-welds. They can be used for any pressure or temperature for which the pipe is used, with equal safety. All are made to conform to the American Standard for Steel Butt-Welding Fittings (B16.9–1940) and are suitably tested and highly accurate in all dimensions.

The line includes, too, Forged Steel Flanges—Welding Necks, Slip-On, and Cranelap, (for use with Cranelap Welding Nipples)—in a full range of sizes, in all pressure classes. They are made in a variety of materials with various flange facings.

•

SOCKET-WELDING FITTINGS—ideal for use in small pipe lines, are available in carbon and carbon-molybdenum steel for use with corresponding pipe.

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design data, coastal sediment problems, site criteria, the design and construction of coastal works, and case histories of coastal projects. A large number of papers but very few books having been published on coastal engineering, this large symposium offers, between its covers, a great amount of modern material. It is illustrated with diagrams, maps and photographs.

Consciousness and Behaviour: a Neural Analysis of Behaviour and of Consciousness. J. T. Culbertson. Dubuque, Iowa, William C. Brown, c1951. 210 pp., illus., $4.25.

This book is concerned with neural activity, its antecedents in the form of stimuli, and its consequents: behaviour and consciousness. It consists of two parts: the neural analysis of behaviour and the neural analysis of sense data. In all cases, it investigates pure nerve theory, but disregards nerve nets embodied in actual organisms. Although numbers and other symbols are used frequently in this work, the reader does not need knowledge of differential or integral calculus or of any other branch of higher mathematics. The book is illustrated with circuit and nerve net diagrams.

Flood Damage and Flood Control Activities in Asia and the Far East. Bureau of Flood Control, Economic Commission for Asia and the Far East. Bangkok, The Commission, Toronto, Ryerson, 1950. 82 pp., maps, $1.50.

Material for this study has been obtained from replies of organizations of member countries of E.C.A.F.E. to a questionnaire addressed to them by the bureau, and from technical documents supplementing these replies. It is divided in three parts. The first is a summary hydrology of Asia and the Far East. It deals with temperature, pressure and wind, precipitation and cyclone, run-off and silt-flow. The second is on the development of flood control works of the region. It deals with river alluvium, influence of population pressure on the development of flood control works, physiographical influence on flood control measures and development of flood control methods. The last part deals with flood damage and flood control of nineteen rivers of the region: the Ganges, the Yangtze, the Yellow River, etc. An appendix gives a summary of basic data of rivers. The whole book is built around abundant statistical data and maps.

Introduction to the Gas Turbine. D. G. Shepherd. Toronto, Longmans Green, c1950, 387 pp., illus., $5.30.

This book is presented with the aim of filling a gap between the largely descriptive matter for the general reader and the technical papers of interest only to the specialist. Although intended for those with some technical background, each topic is introduced with some explanation of the fundamentals underlying it. Following initial chapters on the basic physical and engineering concepts, the various components are described, and an outline of some design methods is given. The remaining chapters deal with the gas turbine as a unit, and are chiefly intended as illustrations of the practical applications of theoretical and experimental work. Most illustrations are line diagrams. References are given at ends of chapters.

Machine Drawing. Deane Lent. New York, Prentice-Hall, 1951. 523 pp., illus., $8.80.

The present work offers complete material for both elementary and advanced courses in technical institutes, colleges, or engineering schools. Chapters follow the development of a machine from design to production start. The fundamental drafting techniques, principles of projection, and conventional representation are presented with great care in this text. A particularly thorough treatment of dimensioning is given, from basic rules to problems of mass production, with the accent on clearness and utility. Individual problems are offered in the elementary work and project problems in detailing and assembly drafting. An appendix contains many tables of use to the draftsman.

Principles and Practice of Radar. H. E. Penrose and R. S. H. Boulding. Toronto, British Book Service, c1950. 708 pp., illus., $8.50.

An adequate knowledge of fundamental radio theory is required of the reader. However, as a refresher, early chapters discuss the operation of basic equipment such as the thermionic tube, amplifiers, oscillation generators, and the cathode ray tube. In the sections dealing with modifications and new techniques, much consideration is given to pulses and pulse forming circuits, to calibration, and to applications of micro-wave technique to transmitters, receivers, and feeder and aerial systems. The important subject of the resonant magnetron and its associated units receives special attention.

Rockets, Missiles, and Space Travel. Toronto, Macmillan, 1951. 436 pp., illus., $5.95.

Some of the material in this book appeared in Willy Ley's earlier "Rockets and Space Travel", but the entire volume has been revised in the light of recent developments in rocket missiles for military and research purposes. Added material also includes a sound discussion of the establishment of an orbital station and of a moon station. On the whole, the book is made of about two-third historical information and about one-third future developments as seen by the author. This last part discusses at length the spaceship, the space station, inter-continental rocket flights, etc. It is illustrated with drawings and photographs, contains appendices with many useful tables, and an extensive bibliography.

U.S. National Bureau of Standards, Annual Report. Washington, The Bureau, 1950. 109 pp., illus., 50 cents. (Miscellaneous Publications, No. 200).

During the year 1950, the National Bureau of Standards has been concerned with the following subjects and developments: Electricity and optics; metrology; heat and power; atomic and radiation physics; chemistry; mechanics; organic and fibrous materials; metallurgy; mineral products; building technology; applied mathematics; electronics; automatic computing machines; radio propagation; testing, calibration and standard samples. The present work contains short reports on each of these, and is well illustrated with photographs.

Welding Principles for Engineers. J. L. Morris. New York, Prentice-Hall, 1951. 511 pp., illus., $6.00.

Publications dealing with the subject of welding, usually discuss a single process or a phase within a process. This textbook, however, covers all the current processes, in a manner appropriate to training on the college level. This book is directed at the engineering college group and, for this reason, contains relatively few of the explanations and techniques suited to vocational and trade school groups. It is recognized that some colleges include welding laboratory exercises in the engineering curriculum. In this book, however, no welding exercises are included, it being left to the instructor to organize his own. Photographs and diagrams are included.

The following book notes appear here through the courtesy of the Engineering Society Library of New York. The books may be consulted at the Institute Library.

ASTM Standards on Petroleum Products and Lubricants (with Related Information). Prepared by ASTM Committee D-2, Philadelphia, American Society for Testing Materials, 1951. 783 pp., illus., $5.75.

The 129 standards published in this compilation include 116 test methods, 7 specifications, one classification, 3 lists of definitions relating to petroleum, specific gravity, and rheological properties of matter, and 2 tentative recommended practices. The standards are arranged in broadly classified groups, with an additional listing of the contents in numerical order of the standards designation.

Basic Electrotechnics. B. L. Goodlet. Toronto, Longmans, 1951. 247 pp., illus., $4.20.

This text is designated to provide the basic minimum of electromagnetic theory required in order to understand modern developments in electrical engineering. The area covered is indicated by the chapter headings; steady electric currents; electrostatic fields, condensers, and dielectrics; electrodynamics; calculation of magnetic fields; alternating currents; Maxwell's equations and electromagnetic waves. Some knowledge of physics and calculus is assumed.

Elementary Text in Hydraulics and Fluid Mechanics. R. W. Powell. Toronto, Macmillan, 1951. 316 pp., illus., $4.95.

Beginning with hydrostatics and the fundamentals of fluid flow, the author continues with analysis of orifices, tubes, nozzles and weirs. Pipe flow is dealt with in two chapters and open-channel flow in one. Further effects of viscosity, surface tension, and compressibility are discussed, and the use of hydraulic models is explained. Various data tables and certain specialized treatments are appended.

Equivalent Circuits of Electric Machinery. (General Electric Series). Gabriel Kron. New York. Wiley, 1951. 278 pp., illus., $12.50.

In this book equivalent circuits (**stationary** electric-circuit models) are developed for all **rotating** electric machines and groups of machines by means of a unified physical picture, without any mathematical analysis. The behaviour of all types of machines or groups of machines is represented under all operating conditions that may be expressed in terms of constant, sinusoidal or sums of sinusoidal currents and speeds. Short circuits, sudden load variations, etc. are covered as well as steady-state, constant-speed operation. Most of the circuits given appear in this book for the first time.

Helicopter Analysis. A. A. Nikolsky. New York, Wiley, 1951. 340 pp., illus., $9.40.

A general physical picture is given of helicopter theory, and a possible approach is provided to the analysis of some basic helicopter problems. Topics covered include the following: the helicopter in steady vertical flight; hinges, flapping, and feathering systems; forward flight; and the elastic analysis of rotor blades. Particularly important are the three chapters covering dynamic stability and control, a considerable part of which represents the author's original analysis.

Water and the Power, Development of the Five Great Rivers of the West. A. N. Williams. New York, Duell, Sloan and Pearce, 1951. 378 pp., illus., $4.50 (U.S.).

This book indicates the major trends in the development of the five major Western rivers—the Colorado, Sacramenti and San Joaquin, Rio Grande, Missouri, and Columbia Rivers. It shows the effects of the development of these rivers on the land and the people. A summation of the over-all problem of water supplies, including the question of public *vs.* private power is also given, as well as a bibliography.

Yearbook of the Heating and Ventilating Industry, 1951. Issued in collaboration with the Association of Heating, Ventilating and Domestic Engineering Employers by Technitrade Journals, London, 1951. 284 pp., illus., 8/-.

The current edition of this annual publication offers a half-dozen technical articles in the field, a thirty-three page bibliography of articles published during 1950, a buyers' guide to British suppliers of heating and ventilating equipment, a list of British trade names and other miscellaneous information connected with the industry and its organizations.

STANDARDS

ASTM publications, American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania.

Bituminous Materials for Highway Construction, Waterproofing, and Roofing. 330 pp., illus., $3.25.

This standard includes 36 specifications and 56 methods of testing covering highway construction materials, and waterproofing and roofing materials, such as asphalts, tar and coal-tar pitch, fabrics, felts, shingles, creosote, and many others. It also includes volume correction tables and information on viscosity measurement by means of the Saybolt viscosimeter. Recommended practices cover accelerated weathering test and bituminous mixing plant inspection, while definitions are given for terms relating to bituminous waterproofing and roofing materials (17 definitions), materials for roads and pavements, specific gravity, and timber preservatives.

Triaxial Testing of Soils and Bituminous Mixtures. 303 pp., illus., $3.50. (Being Special Technical Publication No. 106).

The word "triaxial" is applied to a form of mechanical test in which a load is applied axially to a cylindrical specimen, while a supporting pressure is maintained against its sides by water, air, or other means. Within the fields covered by this symposium of 13 papers, the test is applied to materials belonging to the class of plastics rather than to that of rigid-elastic materials; a plastic in this sense is a material which, under stress, flows rather than ruptures and which has either no yield point at all, or a very low one in relation to its total resistance to shear. Several papers deal with the application of this test in the design of soil subgrades and bituminous mixes for highway work.

British Standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W.1. British Standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 1780 : 1951—Pressure Gauges. 6/-

This standard deals with indicating pressure gauges, vacuum gauges and combined pressure and vacuum gauges of the Bourdon tube type from 2 in. to 12 in. nominal size and having maximum scale revisions up to 16,000 lb./sq. in. or up to 6 tons/sq. in. It covers test gauges with concentric scales and industrial gauges with both concentric and eccentric scales.

B.S. 1784 : 1951—Test Code for Carburetted Water Gas Plant. 7/6.

This test-code applies to the manufacture of carburetted water-gas in cyclicly operated plant and contains the necessary provisions for the experimental determination of the yields and quantities of the gas made, together with explanations of how these should be measured. It excludes, however, references to data which are not necessary to a general evaluation of the behaviour of a given plant.

B.S. 1788 : 1951—Street Lighting Lanterns. 3/-.

This standard is in two parts, the first being devoted to lanterns for electric lighting and the second part to lanterns for gas lighting. Both parts deal with the mechanical and constructional features of lanterns, exclusive of auxiliaries and lamps in the case of electricity, and excluding governors, ignition devices and controllers in the case of lighting by gas.

Canadian Standards. Canadian Standards Association, National Research Building, Ottawa.

CSA HN Series: HN 1, HN 2, HN 4, HN 5, HN 7. $3.50.

This publication will be useful to Canadian users of nickel and high nickel alloys, who, in the absence of Canadian specifications covering these materials, have been forced either to order without reference to specifications, or to use non-Canadian specifications. HN 1 deals with general specifications: inspection and rejection, workmanship and finish, marking, test procedures; HN 2 deals with standard tolerances: plate, sheet and strip, rods and bars, pipe and tubing; HN 4 deals with plate, sheet and strip: nickel, nickel - copper, nickel - chromium - iron; HN 5 deals with rods and bars: nickel, nickel-copper, nickel-copper-iron; HN 7 deals with pipe and tubing: nickel seamless, nickel-copper seamless, nickel-chromium-iron, seamless nickel and high nickel alloy condenser evaporator and heat exchanger tubes.

Institution of Electrical Engineers, Regulations. Institution of Electrical Engineers, Savoy Place, London.

Abridged Wiring Regulations, 1951, Based on 12th ed., 1950. 83 pp., 5/-.

These abridged regulations comprise only the requirements applicable to domestic installations using single-phase a.c. supply, and omit matters which are not the concern of those engaged in work on site, the assumption being made that the proper planning and ordering of materials has been done beforehand, so that the materials on the site are in accordance with the full regulations. They cover supply, final sub-circuits, conductors and cables, accessories and lighting fittings, current-using appliances, electric discharge lamps, earthing and testing of installations. An appendix covers regulations for earthing to water-mains. This publication contains tables and an index.

BOOKS RECEIVED

Asphalte in Modern Building Construction. G. J. Hancock. London, Newnes, c1950. 230 pp., illus., 30/-.

Broadcast Operator's Handbook, H. E. Ennes. New York, Rider, c1951. 440 pp., illus., $5.40.

Building Estimator's Reference Book: A practical and thoroughly reliable reference book for contractors and estimators engaged in estimating the cost of and constructing all classes of modern buildings, 11th ed. F. R. Walker. Chicago, Frank R. Walker Co., c1950. 1780 pp., illus., $15.00.

Vest-pocket Estimator: containing in tabular form material quantities and labor hours or estimating the cost af all classes of building construction, 11th ed. F. R. Walker. Chicago, Frank R. Walker Co., c1950. 220 pp., illus., included with building estimator's reference book, not sold separately.

Creep of Metals. L. A. Rotherham. London, Institute of Physics, 1951. 80 pp., illus., 15/-. ("Physics in Industry" series).

Design and Placing of High Quality Concrete. D. A. Stewart. London, Spon. c1951. 112 pp., illus., 25/-.

Finite Deformation of an Elastic Solid. F. D. Murnaghan. New York, Wiley, 1951. 140 pp., illus., $4.00. (Applied Mathematics Series).

Fractional Horse Power Motors. S. F. Philpott. London, Chapman, c1951. 367 pp., illus., 30/-.

Internal Constitution of the Earth, 2nd ed. Beno Gutenberg ed. New York, Dover, c1951. 439 pp., illus., $6.00 (2nd rev. ed. of v. 7 of the "Physics of the Earth" series, published in 1938, and prepared by the Committee on the interior of the earth, of the U.S. National Research Council).

Man the Maker: A History of Technology and Engineering. R. J. Forbes. New York, Henry Schuman; Toronto, Thomas Nelson, c1950. 355 pp., illus., $5.00.

Mechanics Applied to Vibrations and Balancing, 2nd ed. London, Chapman, 1951. 584 pp., illus., 50/-

Modern Pyrometry. C. H. Campbell. New York, Chemical Publishing Co., 1951. 150 pp., illus., $4.00.

Non-destructive Testing of Metals. R. F. Hanstock. London, Institute of Metals, 1951. 163 pp., illus., $3.50. (Institute of Metals Monograph and Report Series No. 10).

Northern Countries. Foreign ministries of Denmark, Finland, Iceland, Norway and Sweden. Ottawa, Legations of Denmark, Finland, Iceland, Norway and Sweden, 1951. 154 pp., illus.

Physical Aspects of Colour: An Introduction to the Scientific Study of Colour Stimuli and Colour Sensations. P. J. Bouma. Eindhoven, Holland, Philips' Technische Bibliotek 1947. 312 pp., illus., $5.00.

Punched Cards: Their Applications to Science and Industry. R. S. Casey and J. W. Perry, editors. New York, Rheinhold, 1951. 506 pp., illus., $10.00 (U.S.).

Receiving Tube Substitution Guide Book, First Supplement. H. A Middleton. New York, Rider, c1951. 44 pp., illus., 99 cents.

Resistance of Piles to Penetration with Tables of Approximate Values Based on the Hiley Formula, 2nd ed. R. V. Allin. London, Spon, 1951. 126 pp., illus., 21/-.

Some Aspects of Fluid Flow: Being the papers presented at a conference organized by the Institute of Physics at Leamington Spa on 25th-28th October, 1950, and the reports of the conference discussion groups. London, Edward Arnold, Toronto, Longmans, Green, c1951. 292 pp., illus., $10.00.

Steels in Modern Industry: A Comprehensive survey by 29 specialist contributors. W. E. Benbow ed. London, Iliffe. c1951. 562 pp. illus., 42/-.

TECHNICAL BULLETINS RECEIVED

British Electrical and Allied Industries Research Association. Technical Reports:

No. F/T172—Cathode corrosion of a lead sheath, by G. Mole. No. G/T257—Intrinsically safe electrical apparatus: relation of igniting current to circuit inductance for inflammable mixtures with air of carbon monoxide, coal gas and hydrogen, by E. M. Guenault and E. Atherton. No. G/XT35—Note on the quantity and constitution of gas liberated during arcing in oil, by C. E. R. Bruce and W. B. Whitney. No. G/XT66—The gases liberated during arcing in the side-blast baffle circuit-breaker, by C. E. R. Bruce and W. B. Whitney. No. L/T214—The electrical breakdown of gases at 2,800 megacycles per second, by W. A. Prowse and W. Jasinski. No. L/T244—Barium titanate twinning at low temperatures, by R. G. Rhodes. No. M/T102—A single frequency instrument for the measurement of interference with television reception due to ignition systems. No. M/T105—The study of balanced harmonics in an overhead ring main system (East Cornwall tests), by A. Butterworth and H. R. J. Klewe.

Canada. Department of Mines and Technical Surveys. Mines Branch. Reports:

No. 830—The Canadian mineral industry in 1949. No. 832—Analyses of Canadian crude oils, by H. McD. Chantler, P. B. Seeley and F. E. Goodspeed.

Canada. Associate Committee on the National Building Code. Drafts for Comment:

Revision of national building code, section on construction safety measures.

Institution of Civil Engineers. Reports:

No. 19, 2d ed—Deterioration of timber, metal, and concrete exposed to the action of sea water.

International Joint Commission United States and Canada on the Pollution of Boundary Waters. Reports:

Report 1951.

Steel Founders' Society of America. Recommended Practices:

Recommended practices for the welding of steel castings.

U.S. Highway Research Board. Bulletins:

No. 44—Volcanic ash and laterite soils in highway construction.

PAMPHLETS RECEIVED

Aluminum in World Affairs. Richard Redler. Toronto, Canadian Institute of International Affairs, 1951. ("Behind the headlines" series, v. 11, no. 5, November 1951).

B.C. Coast Woods. B. C. coast woods trade extension bureau, Vancouver, 1951.

Canadian Chamber of Commerce. Policy Declaration and Resolutions 1951-1952. Canadian Chamber of Commerce, Montreal, 1951.

Canadian Depreciation Guide, revised to November 1, 1951. CCH Canadian Limited, 1951.

Industrial Diamond Trade Names Index for 1951-1952 for users of diamond tools, hard abrasives, sintered carbides, and materials for the precision engineer. Industrial Diamond Information Bureau and Industrial Diamond Review. London, N.A.G. Press Limited, 1951.

Oil in World Affairs. R. S. Ritchie. Toronto, Canadian Institute of International Affairs, 1951. ("Behind the Headlines" series, v. 11, n. 3, September 1951).

Precision Radio Time Signal System. D. W. R. McKinley and B. E. Bourne. Ottawa, National Research Council, 1951. (Canadian Journal of Technology, v. 29, October 1951, and N.R.C. No. 2513 reprint).

Quality and Uses of Exotic Softwoods in South Africa. M. H. Scott. Department of Forestry, Pretoria, 1951. (Empire Forestry Review, v. 30, n. 3, 1951, reprint).

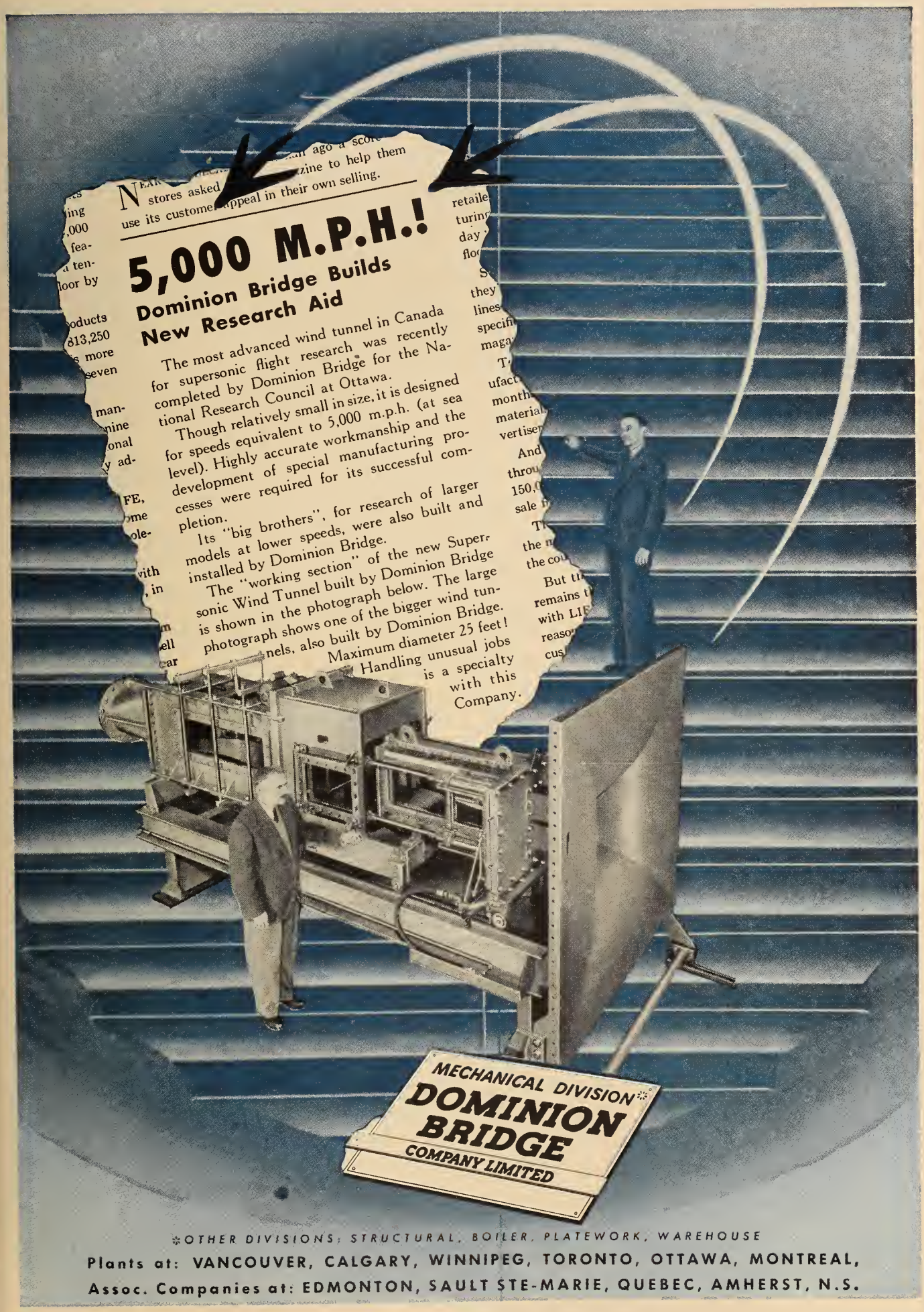
Variation of Meteor Echo Rates with Radar System Parameters. D. W. R. McKinley. Ottawa, National Research Council, 1951. (Canadian Journal of Physics, v. 29, September 1951, and N.R.C. No. 2502 reprint.)

JANUARY ISSUE

A heavy demand for the January issue of *The Engineering Journal* has completely exhausted the supply at Headquarters.

Members who do not keep their *Journals* on permanent file and who have finished with their January issues, are invited to return their copies to Headquarters for redistribution.

Address to: The Library,
Engineering Institute of Canada,
2050 Mansfield Street,
Montreal, Quebec.


5,000 M.P.H.!
Dominion Bridge Builds New Research Aid
The most advanced wind tunnel in Canada for supersonic flight research was recently completed by Dominion Bridge for the National Research Council at Ottawa.
Though relatively small in size, it is designed for speeds equivalent to 5,000 m.p.h. (at sea level). Highly accurate workmanship and the development of special manufacturing processes were required for its successful completion.
Its "big brothers", for research of larger models at lower speeds, were also built and installed by Dominion Bridge.
The "working section" of the new Supersonic Wind Tunnel built by Dominion Bridge is shown in the photograph below. The large photograph shows one of the bigger wind tunnels, also built by Dominion Bridge. Maximum diameter 25 feet!
Handling unusual jobs is a specialty with this Company.
MECHANICAL DIVISION
DOMINION BRIDGE
COMPANY LIMITED
*OTHER DIVISIONS: STRUCTURAL, BOILER, PLATEWORK, WAREHOUSE
Plants at: VANCOUVER, CALGARY, WINNIPEG, TORONTO, OTTAWA, MONTREAL,
Assoc. Companies at: EDMONTON, SAULT STE-MARIE, QUEBEC, AMHERST, N.S.

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

New Equipment and Developments

Atlas Steel Expansion.—The first strip mill in Canada for the production of stainless steel strip will be erected by Atlas Steels Limited on its properties at Welland, Ont., as the result of recent financing which has made $8,000,000 available for expansion.

In addition the Company will build and put into operation equipment for the manufacture of welded stainless steel tubing.

Expansion will take approximately two years to complete and is part of an unfolding programme of pioneering in stainless steel started nearly two years ago when Atlas gave Canada its first mill for the hot rolling of stainless steel sheet. A cold reduction mill is scheduled for operation during the current month.

With warehousing facilities now established from coast to coast, Atlas expects to be able to furnish most of Canada's requirements for stainless strip, sheet, light gauge plate, billet, tube, bar, rod and wire.

It is anticipated that the expansion of Atlas Steel's facilities for producing stainless steel will make Canada independent of outside supply for the first time in history.

•

International Nickel Pipeline.—A seven and one half mile pipeline has been completed by The International Nickel Company of Canada, Limited. Through this line the bulk concentrate from 3,650,000 tons of nickel-copper ore is being pumped annually from its newly-built Creighton concentrator to the reduction plant at Copper Cliff. It is believed that never before has concentrate been carried by pipeline in such quantities over such a distance.

•

Friction Clutches.—A new range of centrifugal friction clutches has been developed by a Bolton, England, firm. These clutches are designed for fitting direct on to the electric motor shaft or other high-speed driving shafts. The driving, or fixed half, is provided with four arms which retain four weights in course of rotation. These weights are retained axially by the casing on the one side and the aluminium cover on the outside. Each cast-iron weight has a friction pad screwed to the outer face and is restrained in outward movement by a flat spring engaging with the driving arms and adjusted by set-screw and locknut. The minimum number of revolutions per minute for this type of clutch is 700, with a maximum of 3 h.p. at this speed. For further information communicate with B. and F. Carter, Waterloo Street. Bolton, Lancs., England.

•

New Link-Belt Building.—Link-Belt Limited has announced the erection of a new building on an eleven and a half acre site on Boundary Road, Burnaby, B.C.

The new quarters will provide space for larger stock of conveyor and power transmission parts to meet the growing needs of Vancouver and British Columbia. H. J. Harris will continue to direct the sales and engineering service activities of the Vancouver office with which he has been associated since its establishment in 1930.

•

New U.K. Trade Centre.—The United Kingdom opened another offensive a few nights ago, in search of needed dollars, when a British Trade Centre was officially opened at 1437 Mackay street, Montreal. It will be under the direction of Arthur Laing, M.B.E., retired collector of customs in Montreal.

The purpose of the trade centre is to boost the sale of British goods in eastern Canada. It follows the opening, last June, of a similar centre in Toronto Plans are being made for the opening of a third centre in western Canada.

Commenting on the new centre Lewis J. B. Forbes, president of the Canadian Association of British Manufacturers and Agencies, under whose auspices the centre will function, said "The Canadian Association of British Manufacturers and Agencies, was formed in May, 1951, as a step in the co-ordination of existing organizations, engaged, both in executive and advisory capacities, in the development of trade between the United Kingdom and Canada."

•

Voltage Regulator.—A new single-phase, 32-step voltage regulator with ratings particularly suitable for branch and rural circuits, is available from Canadian General Electric Company, Limited.

Designated as the ML32, the new regulator supersedes the company's eight-step ML8. The new regulator offers 10 per cent raise and 10 per cent lower regulation in 32, five-eighth per cent steps.

Designed to include all ratings covered by the ML8, the ML32 is available in voltage classes of 2500, 5000, and 7620 volts with insulation levels designed for the corresponding "Y" voltages. Improvements include a modified, rapid switching process designed to give maximum contact life and quiet operation. Controls are on a new type neatly arranged panel essentially the same as those used on large power transformers with load ratio control. A new type magnetic position indicator is located on the tank for easy reading from the ground.

•

Taylor Instruments Expansion.—Taylor Instrument Companies of Canada Limited, 110 Church Street, Toronto, affiliated with Taylor Instrument Companies, Rochester, N.Y., has purchased a prominent four-acre site on Tycos Drive (named in their honour), west from 2800 Dufferin Street, Toronto. Plans are now being developed for the erection of a single-storey plant and head office to take the place of the present premises.

Instruments are continuing to become more and more important key equipment in industry. With this in mind, and to better handle more than 8000 different types, ranging from household and weather instruments up to the most modern graphic panels, automatic controllers of temperature, pressure, flow, liquid level, specific gravity and speed, the new plant is being designed. While the parent company has just celebrated its 100th anniversary, the Canadian organization has been established for over 38 years.

•

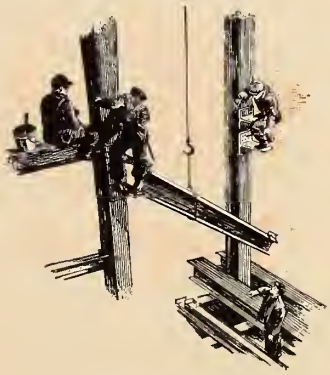
Imperial Oil Refinery.—A thirteen and one half million dollar construction programme at Imperial Oil's Ioco refinery will begin early this spring. Preparation of the site will get under way within the next few weeks and erection of the new equipment will start in the fall. It is hoped the work will be completed late in the fall of 1953.

Perfection the Sum of Many Details

IN this magnificent tapestry every separate stitch was made under the supervision of a master craftsman, and each contributes its part to the whole effect.

Likewise in steel construction, every detail of design and workmanship must be studied, and each contributes to the safety and durability of the finished structure. But once it is complete, these all-important details are no longer visible, and your only assurance lies in the integrity and reputation of the fabricator.

XVth Century Flemish Tapestry. Reproduced by kind permission of the Owners, The Montreal Museum of Fine Arts.



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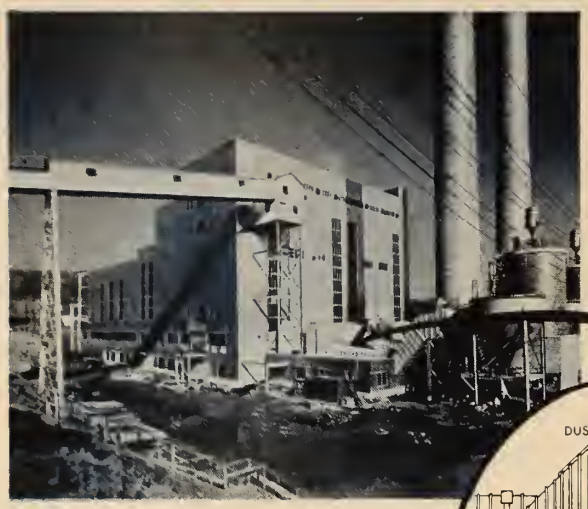
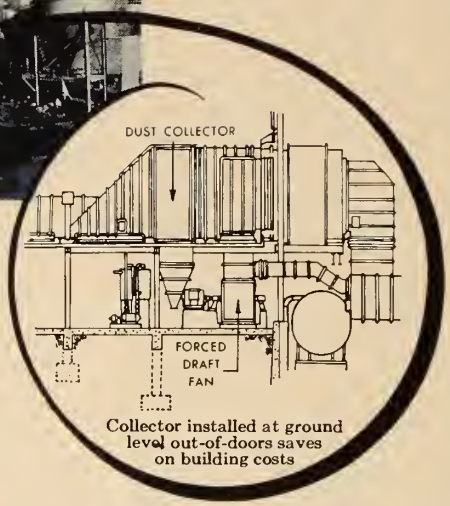
Dominion Bridge

Company, Limited



Titus Station
Metropolitan Edison Co.
Reading, Pa.



Collector installed at ground level out-of-doors saves on building costs

Answer *your* specific dust control problems with an

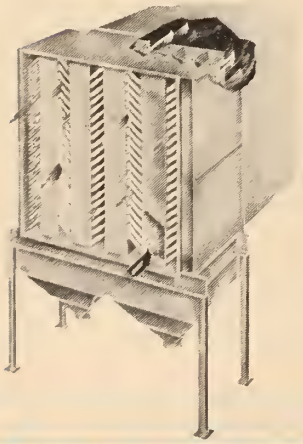
AEROTEC

DUST COLLECTOR
exactly tailored to your needs

Here is one of the many instances in which the Aerotec Design 3 RAS Dust Collector proved its high efficiency so conclusively that Metropolitan Edison purchased a third unit. Gilbert Associates Inc., of Reading, Pa., were designers and constructors. Three bituminous coal-fired steam generators at this modern power plant, will be equipped with Aerotec Collectors. Layout and breeching are so designed that an Aerotec electrical secondary can be added at a future date without loss of the initial investment.

This mechanical collector, with its multiple, small-diameter tubes, offers you the advantages of high dust recovery in the ultra-fine ranges, even at partial load. The tubes are permanent mold aluminum castings of absolute uniformity. This construction provides the smooth inner wall necessary to ultra-fine dust collection. Tubes are assembled at the factory in lightweight "building block" sections. These assemblies permit flexible arrangement to suit your needs, with the economy of standard construction.

Let our engineers bring to your problems the benefits of their long experience in the field of flyash collection. No obligation.



Typical Inlet and Outlet Variations

Straight through — Top outlet — Top inlet

Catalog 601 gives you complete details on standard and special Aerotec arrangements, plus other useful data on dust collection. Call or write for your copy today.

Project Engineers
THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 28 Principal Cities)
Canadian Affiliates: T. C. CHOWN, LTD.
Montreal 25, Quebec — Toronto 3, Ontario

THE AEROTEC CORPORATION
GREENWICH, CONN.

The enlarged refinery will process crude oil brought from Alberta by pipe line. When the expansion programme is completed the refinery will have a capacity of 22,500 barrels a day, compared with a current capacity of 12,000 barrels a day. New equipment will replace most of the existing units. It will include a fluid catalytic cracking unit with a capacity of 7,500 barrels a day. Other equipment to be installed will include atmospheric and vacuum distillation units, a gas recovery unit and a treating plant where various products will receive their final processing. All of the process units will be operated from a central control room which will contain the latest type of instrument panel.

Tenders for the construction of the new plant will be called for soon.

●

New Ingersoll-Rand Motor Starters.—Two new air starting motors for cranking gasoline and diesel engines are announced by Canadian Ingersoll-Rand Co. Ltd., 620 Cathcart Street, Montreal, Que. They are expected to be used in the lumbering, petroleum, mining, marine, heavy construction and power fields. They are designed for cranking diesel and gasoline engines with piston displacements up to more than 3,500 cubic inches. Although normally operated by compressed air, they are also suitable for operation on natural gas when available at sufficient pressure.

The starters are available in two sizes; the size 9BM, which develops up to 16 hp. and requires approximately seven cubic feet of air per start; and the size 20 BM, which develops up to 41 hp. and requires approximately 16 cubic feet of air per start. The smaller size weighs 40 pounds, and the larger size, 103 pounds. Complete information will be forwarded by the manufacturer on request.

●

Polythene Plant.—Canada's first plant for the manufacture of polythene, will be built in Edmonton by Canadian Industries Limited, at a cost of about $13,000,000. Construction is scheduled to begin next spring with production starting late in 1953.

The plant will employ more than 200 persons, the majority being recruited from the Edmonton district. Operations will require about 10,000,000 cubic feet of natural gas, 8,000,000 gallons of water and 35,000 kilowatt-hours of electricity a day. John D. Wright, now manager of C.I.L.'s Windsor, Ont., chemicals plant, will be manager of the polythene plant.

●

Huge Furnace Transformer.—Design work is now under way at Canadian Westinghouse on what will be the world's largest furnace transformer. Ordered by the North American Cyanamid Company of Niagara Falls, the 25,000 KVA three phase transformer will supply power to special furnaces. The KVA parts are approximately twice the size of any previously manufactured furnace transformer.

●

Canadian Trade Fair.—Canadian business and industry is backing Canada's International Trade Fair to a greater extent than ever before. Already Canadian space bookings are well ahead of the total amount taken by Canadian exhibitors in either the 1950 or 1951 Trade Fairs. To date Canadians have booked

45,000 square feet of exhibit space to show products in every one of the sixteen trade categories in which the Fair is divided. The most noticeable increase is in the section containing machinery and plant equipment. Here Canadian manufacturers have 20,000 square feet.

Germany will exhibit in a major way for the first time, particularly in the machine tool section. Britain, continuing her drive to establish and maintain broad Canadian markets, will again be one of the top exhibitors in almost every category. British machine tools are expected to be one of the major features but this year machine tool makers will be showing on an individual basis rather than as an association.

•

New "Impactool".—A new heavy duty universal electric "Impactool" for tough nut running jobs in truck, bus, and industrial maintenance fields has just been announced by the Canadian Ingersoll-Rand Company. Known as the Size 34U Impactool it has a 1" square driver and is rated for bolts up to 1¼" size.

The 34U employs a heavy duty, universal electric motor and a proven I-R Impact Unit, placed side by side to reduce overall height, which permits handling truck U-bolt nuts without jacking up the truck. The impact mechanism automatically converts the power of the electric motor into hundreds of rotary impacts whenever sufficient resistance to turning is met. For complete information write to the Canadian Ingersoll-Rand Company Limited, 620 Cathcart St., Montreal.

•

Field Plotter.—A new portable analog field plotter, a versatile tool for rapid solution of complex two-dimensional field problems, has been announced by the special products section of Canadian General Electric Company. The new G.E. product sets up electrical field patterns in a thin conducting-paper surface on a plotting board. Analogy between the electric field in the paper and the related field problems—such as might exist in electrostatics, electromagnetics, thermal and fluid flow, etc. — allows an easy solution to a broad range of difficult problems.

It consists basically of a plotting board and exploratory stylus, d-c power supply operated from 115 volts a-c, a high accuracy multi-turn voltage divider, sensitive microammeter with specially designed overload protection and a supply of conducting paper and silver paint. An instruction book accompanies the plotter. Total equipment has a shipping weight of twenty pounds. For further information communicate with Canadian General Electric Company, 212 King Street W., Toronto.

•

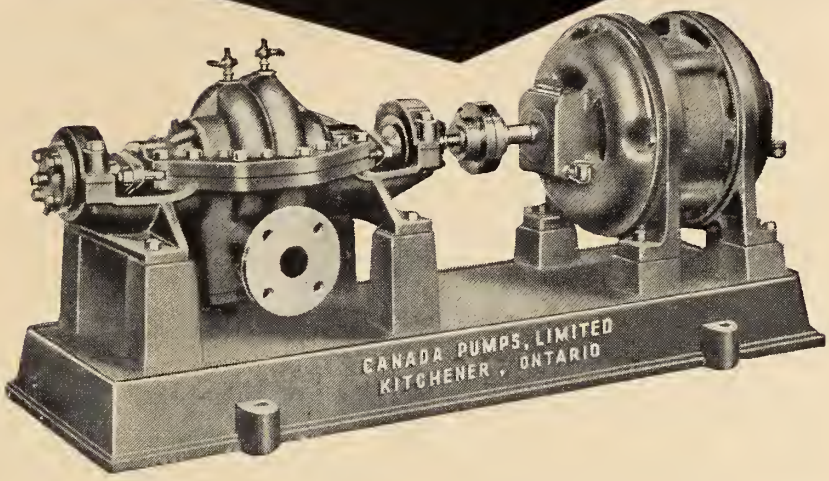
Road Construction. — Record expenditures on Canadian roads of nearly $300 millions are reported in a year-end review released by the Canadian Good Roads Association.

Preliminary estimates for 1952 indicate that a higher level of road building activity will be reached unless material and labour shortages force a revision of present building plans.

The steel division of the Department of Defence Production offers little hope that there will be any improvement in the available supplies of steel.

•

Pumps that keep delivering!



"Canadian Buffalo" GENERAL SERVICE PUMPS

Avoiding pump break-down and ensuing costly shutdowns for repair are vital economy factors in industrial management, as a recent survey has shown.

Here's where "Canadian Buffalo" General Service Pumps like the class "RR" Single Suction, Multistage Pump shown aid your budget. Sturdily built for longer, more efficient liquid handling in every detail . . . packing, impellers, shafts, bearings . . . they have proven themselves in hundreds of installations. Many "Canadian Buffalo" users state that you can "Put them in and forget them"! testifying to their ability to KEEP DELIVERING.

The perfect hydraulic balance and all-around quality workmanship in "Canadian Buffalo" General Service Pumps give you MORE for your pumping dollar.

PUMP FACTS!

You'll find assistance in solving many pumping problems in "Canadian Buffalo" bulletins, including ratings, specifications and other engineering data. *Write us for your copy, or see your nearest representative.*

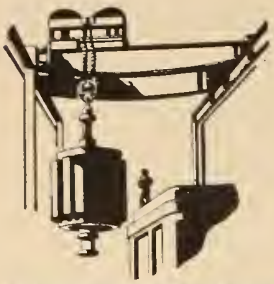
"Canadian Buffalo"

CANADA PUMPS LIMITED

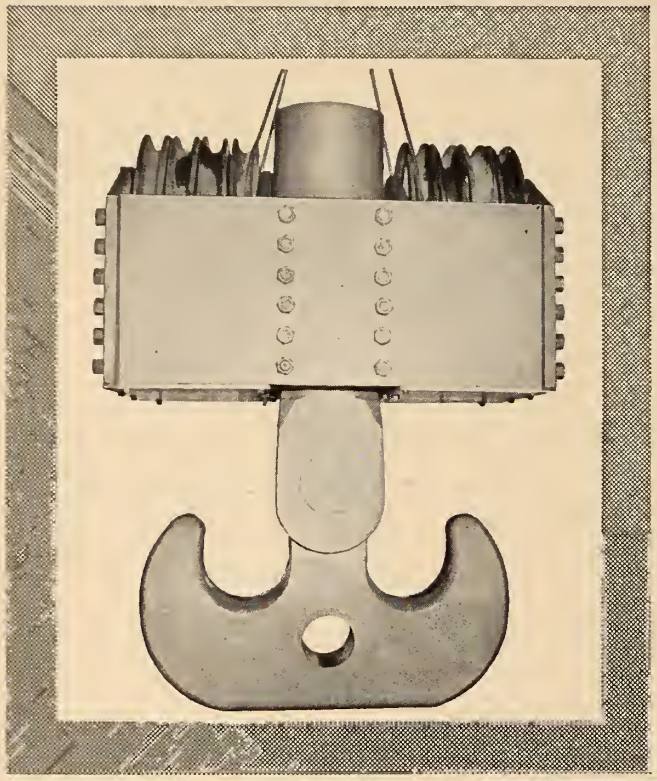
HEAD OFFICE: KITCHENER, ONTARIO

Engineering Sales Offices: MONTREAL TORONTO SAINT JOHN PORT ARTHUR WINNIPEG REGINA CALGARY EDMONTON VANCOUVER

Canforge



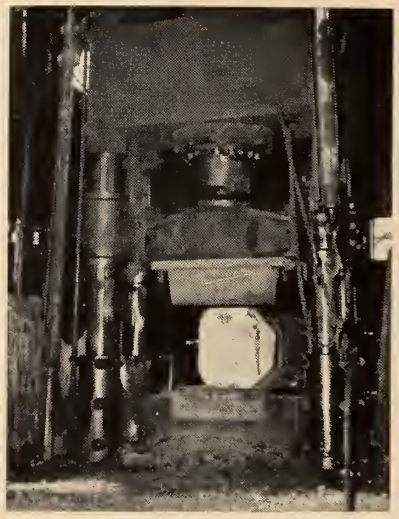
MIGHTY FINGERS FOR MAMMOTH CRANES



Photograph at left shows Hook Block forged in our Welland plant of .35 carbon steel, for 200-ton Electric Travelling Crane built by Provincial Engineering Limited of Niagara Falls, Ontario.

Whether it's a forging to carry heavy loads like this giant hook, or a 40-foot tail shaft for large marine installation, or a powerful axle used in modern diesel locomotives, likely it is a product of Canada Foundries & Forgings Limited. Throughout Canadian industry — in mining, ship building, engineering, hydro-electric, pulp and paper — the great Canforge plant at Welland, with its up-to-date equipment and complete facilities, is first choice when the need is for heavy duty forgings.

Prompt attention given enquiries regarding Light or Heavy Forgings



1,000 Ton Steam Hydraulic Press.

CANADA FOUNDRIES & FORGINGS
LIMITED · WELLAND, ONT.
MONTREAL · BROCKVILLE · TORONTO · WINNIPEG · VANCOUVER

Johns-Manville Expansion. — For the second successive year, Johns-Manville in 1951 set new high records for production of goods, sales, payrolls and earnings, according to Earle Brockett, vice-president, Canadian Johns-Manville Co. Ltd. Mr. Brockett, in presenting his statement said, that additions to and replacements of Johns-Manville properties and investments amounted to $13,103,803 in 1951. "Plans were approved," he said, "for a major expansion and replacements programme at the Jeffrey Mines at Asbestos, Quebec. The site has been cleared for a new mill to extract asbestos fibre from ore. It will expand milling capacity and will eventually replace the present mills. Underground mining facilities are to be enlarged."

•

Trane Convector-Radiator—This month Trane Co. of Canada Limited celebrates the first anniversary of the Trane coderated convector-radiator.

A special series of advertisements on this subject has been prepared. (See this issue of the Journal, Editor.)

•

Nylon Products. — Canadian General Electric Company is now moulding nylon parts in its plastics plant at Cobourg, Ontario. Included in the newly-designed equipment installed in the plant for this purpose is a "nylon nozzle" which prevents "drooling" of the low-viscosity plasticized nylon.

Among the nylon parts to be manufactured at the Cobourg plant are valves and valve components, gears, bearings, rivets, gaskets, washers, bushings, inserts, coil bobbins, terminal boards, sheath for cables, shafts for tools, mechanical door checks, phonograph parts, etc.

•

New Chemical Plant.—Organization of St. Maurice Chemicals Limited as a company owned jointly by Shawinigan Chemicals Limited, of Montreal, and Heyden Chemical Corporation, of New York, has been announced. The new company will produce formaldehyde and pentaerythritol. Estimated cost of the new plant will be $2,000,000.

The plant will be built near Varennes, on the south shore of the St. Lawrence opposite the lower end of the Island of Montreal. It will be accessible to deep-water shipping. Survey work is now under way and actual construction, expected to begin early this spring, will be completed about the end of the year.

President of the new company is V. G. Bartram, president of Shawinigan Chemicals Limited and of Canadian Resins and Chemicals Limited and B.A.-Shawinigan Limited.

The head office of the Company will be located in the Shawinigan building, Montreal. The new plant will occupy 30 of several hundred acres owned by Shawinigan Chemicals in the Varennes district. On adjacent land a new plant is being built by Electric Reduction Company for the production of phosphorus.

•

Micrometer For Travelling Strip. — Strip or sheet metal coming from a cold rolling mill must be measured continuously. Cold rolled steel or non-ferrous metals are produced to close limits and a micrometer is needed for their measurement. With this in view the M.P.J. Gauge and Tool Company Limited, of Hansons Bridge Road, Birmingham,

England, have introduced their "flying micrometer".

The moving material edge passes between a pair of freely rotating rollers which have rounded edges. The mean distance between the rollers can be set by means of a micrometer adjustment and any deviation from the nominal thickness is shown on the dial of an indicating instrument placed in any convenient position. The indicating instrument is operated electronically from the gauging rollers and the connection between the two mechanisms consists of an electric cable. The indicating instrument may thus be placed at a remote distance from the gauging rollers if this is desired.

Range of the indicating dial is 0.0025 inches either side of the central zero line. The dial is calibrated in increments of 0.0001 inches.

•

Machine To Handle Increased Tonnages.—Increased tonnages of meat carcases now being handled by abattoirs and meat factories have shown that the old method of raising carcases to the splitting rails is too slow. With hand-winding methods, slaughterhouse workers have been unable to keep the electric splitting saws fully occupied. The problem has been solved by the production of an electric hoist capable of raising carcases to the splitting rails in a fraction of the time taken by the old methods. Three models of the machine are being supplied by the Bristol Saw Chine Company, Limited, which has factories at Bristol and an export office at 11, Dowgate Hill, London, E.C.4.

Models can be applied to all kinds of abattoirs and meat factories. The lifting speeds range from 22½ feet per minute for the smaller model to 40 feet a minute for the largest. The power drop is 120 feet per minute. The machine has been designed in such a way that the hoist can be mounted on walls or girders. This enables the operator to keep at a distance, while having full control of his work by means of a hand grip.

•

Portable Chlorinating Apparatus. — A development in water treatment is a portable chlorinating apparatus which in an emergency allows any temporary supply of drinking water, as well as sewage effluents, to be sterilized on the spot. The latest methods in this field are represented by the Chloronome equipment of the Paterson Engineering Company, Limited, of 83, Windsor House, Kingsway, London, W.C.2. This embodies their Pulsator type machine fixed on a light iron stand with chlorine cylinders attached, thus forming a self-contained unit of small size and light weight which can be mounted on any type of motor vehicle.

The vehicle can also be arranged as a self-contained water pumping purification and supply unit, including a petrol engine driven pump and small closed sand filter. An armoured suction hose with strainer is dipped into the source of supply, such as a river, stream, canal or pond; the water is next drawn through the small sand filter, and then sterilized continuously and completely by the chlorine gas.

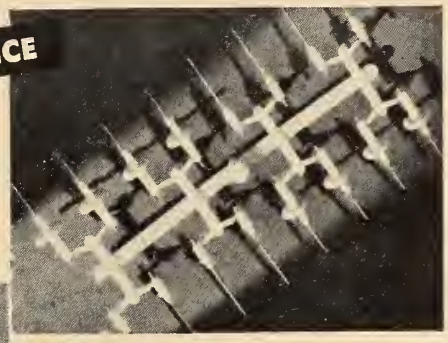
The small Pulser machine has a capacity of up to 10 lb. of chlorine gas per 24 hours and works on the same principle as the larger machines.

•

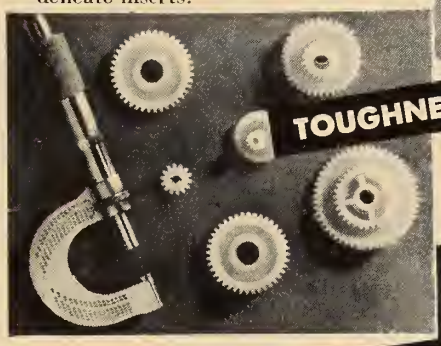
Nylon PLASTIC

- *toughness* • *form stability*
- *abrasion-resistance* • *strength*
- *light weight* • *resistance to chemicals*

HEAT RESISTANCE



High heat resistance allows sterilization of these blood-donor-and-receiver needles. They're moulded at a single shot, illustrating the ability of nylon to be moulded in complicated shapes and around delicate inserts.



TOUGHNESS

Nylon's toughness makes possible gears which have excellent resistance to chemicals and abrasion, and may be produced economically in large quantities by injection moulding. They will often run without lubrication.

IMPACT RESISTANCE

This soft-impact hammer is made with faces of nylon. Although extremely impact-resistant, the nylon does not mar soft metals, and does not chip, mushroom, or become doughy.

WRITE US, on your Company letterhead, for your copies of the informative, helpful publications on nylon plastic.

- **TECHNICAL SERVICE BULLETINS**
- **65 SUCCESS STORIES of Product Improvement**
- **DU PONT NYLON MOULDING POWDER**

We also have complete information on many other plastics — let us know those in which you are interested and we'll send you copies of our publications dealing with them.

CANADIAN INDUSTRIES LIMITED

C-I-L Plastics
SERVING CANADIANS THROUGH CHEMISTRY

Our Technical Service is available to all users and prospective users of C-I-L plastics. Remember, C-I-L is the first place to check when you have a plastics problem. C-I-L sales offices are located coast to coast.

PLASTICS SECTION
Chemicals Department

Listen to C-I-L "Singing Stars", Sunday Evenings, Dominion Network

YOU can get more light, more production for your money with Dayline Industrial Fluorescent lighting . . . engineered to yield maximum reflection. Finished inside in high white porcelain enamel, attractively and durably finished outside in grey, the reflector can be quickly and easily removed for servicing and cleaning. Easily replaceable lamp starters are located behind the lamp sockets. Dayline Industrial units are available for 40 and 100 watt lamps. Fully approved by the Canadian Standards Association.

AEC-L-51-14

AMALGAMATED

ELECTRIC CORPORATION LTD · MONTREAL, TORONTO, WINNIPEG, CALGARY, VANCOUVER

A·E CORP'N LTD.

SOLD BY RECOGNIZED WHOLESALERS FROM COAST TO COAST

Power Unit For Oilfields.—Bearing in mind the constant need to improve the equipment available to oilfield engineers, Davey, Paxman and Company, Limited, of Colchester, Essex, England, have evolved a standardized power unit which is universally adaptable and allows for the maximum of power with the minimum of attention. Known as the "Package" set, this self-contained unit comprises: engine, water and lubricating oil cooling radiator, control gear, steel sided canopy, air intake filters, starting equipment (which can be either air, electric or petrol engine) water and lubricating oil pumps, instrument panel and cooler for hydraulic coupling. All are mounted on a skid-type underbase.

With maximum availability required while drilling is in progress, a sub-frame with drive has been perfected. This allows for interchange of engine units for servicing, without affecting the compound drive to the draw-works. To assist in rapid changeover, the drive between engine and compounding gear is by internal gear type coupling.

•

Descaling Fluid For Metals.—Shortage of fuel and the need for highly efficient use of steam boilers has led to the development of a descaling fluid which is widely used by Britain's Air Ministry, the National Coal Board, public corporations, and gas and electricity undertakings. The fluid is a combination of acids carefully balanced and inhibited to prevent attack on metals. The only exceptions are aluminium and zinc.

In Britain, chemical descaling is the special province of Defur Descaling Services, of 2, Marychurch Street, Rotherhithe, London, S.E.16. The advantages claimed for their method include reduction of time, labour and general maintenance costs, avoidance of costly shutdowns, and economies in fuel consumption. In addition, general dismantling for renewal purposes is almost entirely avoided. The company specialize in dealing with marine plant, laundry, dairy and brewing equipment, but the Defur fluid is equally suitable for defurring, de-scaling and de-rocking all types of industrial and domestic plant.

•

Improved Welding Technique.—A new development to be included in the 1952 British Industries Fair, to be held in London and Birmingham from May 5 to May 16, is an improved method of welding known as the "Twinner Technique". The basic idea is that universal holding tools are set up on the top plate of a welding positioner to receive the workpieces to be welded. The holding tool acts as a jig, and being mounted on the welding positioner, the workpiece can be positioned to suit the welding procedure. Complicated weldments can thus be built up rapidly from a series of sub-assemblies with special jigs, the sub-assemlies being brought together as a final assembly on the welding positioner.

This method is claimed both to economize considerably in production time and to eliminate the cost of special jigs. The "Twinner Technique" is made by Donald Ross and Partners, Limited, 1-3 Arlington Road, London, N.W.1.

•

Submersible Pumping Unit. — Deep-Well Drilling Company, Limited, Station Road, Cowey, Middlesex, England, has introduced an entirely new type of

submersible pumping unit — where both pump and electric motor are set together below water level—for installations in boreholes, etc. The unit has an enclosed and hermetically sealed electric motor, there being no shaft extension The drive is transmitted by a magnetic coupling, located inside the motor, on to a complementary coupling, on the pump shaft, by means of an electric magnetic field which passes through the end shield of the motor.

●

High-Speed Hacksaw. — Designed for heavy-duty high-speed hacksawing, the "Kingsely" can cut a 2-inch mild steel bar in two minutes and 4-inch in seven minutes with the machine running at high speeds, says "The British Trade Journal and Export World". High tensile figures at slow speed are 3½ and 20 minutes respectively. There are two sawing speeds from a V belt drive. Standard electric equipment includes a 1 h.p. three-phase motor and flush-mounted starter and limit switch. Kings Langley Engineering Company, Limited, Kings Langley, Herts, England.

●

Oxygen Recorder. — A paramagnetic continuous oxygen recorder for use in industrial processes has been developed which will meet the usual demands while enabling any industries which have, in the past, relied on inferential oxygen analysis, to adopt direct analysis with the new instrument. Mounted in a small cast aluminium case, the primary unit is compact, says "The British Trade Journal and Export World". The installation is entirely mains-operated and a constant-voltage transformer is supplied with the equipment to smooth out supply-voltage fluctuations. (George Kent, Limited, Luton, Bedfordshire, England.)

●

Gas Turbine Power Station. — One of Britain's first gas turbine power stations, now being built in Hampshire by the Ministry of Supply's National Gas Turbine Establishment, is expected to be in operation by the end of next year, says "The Engineer". Although this 10,000kw station will be primarily an experimental plant for the study of operating techniques, it will generate power for the National Gas Turbine Establishment and, by means of a new system evolved by Ministry engineers, the waste heat given off by the plant will be used to heat the Establishment's buildings. The station may also make a contribution to the national grid.

The installation consists of a low-pressure unit running at 2,800 r.p.m., which in its capacity as a booster supplies compressed air to the main high-pressure turbine. This unit runs at 3,000 r.p.m. and is connected to the alternator. Fuel for both units is to be either kerosene or gas oil.

●

Load Lowering Machine. — A machine for lowering cases, crates and other heavy packages from an upper to a lower floor is announced by British Wedge Wire Company, Limited, Academy Street, Warrington, Lancashire, England. The machine is designed for working in conjunction with conveyors and is fully automatic, requiring no power other than the natural force of gravity, says "Machine Shop Magazine". It occupies a floor area of less than 8 square feet.

A cylindrical tube or pillar connects the upper and lower levels and carries on its exterior a movable carriage which accommodates the load. The carriage is attached to a piston working within the tube, and as the load is dropped into the carriage, its weight causes the carriage to drop to the lower level, and the piston is raised. When the load is removed from the lowered platform, the weight of the piston is sufficient to raise the platform again.

When the carriage moves downward and the piston inside the cylinder is raised, the air that it displaces escapes through a series of ports in the tube walls. As the carriage nears the end of the drop, the air trapped above the piston is compressed and brings the carriage smoothly to a stop. The carriage tips at the end of its drop and the load is transferred to the lower conveyor.

●

Simple Flushing Valve.—A simple sanitary device, the "Pillar" flushing valve, releases two gallons of water each time the button is pressed. The bellows type valve ensures instant flushing, prevents waste, and its operation is not affected by chemical deposits, says "The British Trade Journal and Export World". Service is constant. There is no waiting for a tank to refill. (Campbell Engineering Company, Limited, Bromley, Kent, England.)

●

Centrifugal Spinning Frame.—Involving a departure from accepted spinning

Recommended

water treatment methods

by

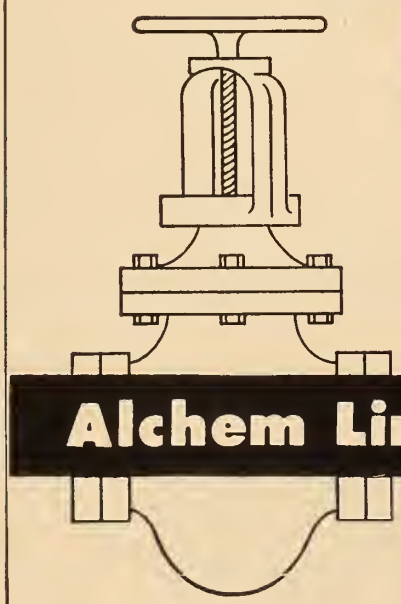
Alchem

lead to

Increased efficiency of your boilers.

Lower equipment maintenance costs.

Consult



Alchem Limited

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ENGINEERING AND CHEMICALS
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technique, the P.S.C. system, the invention of Prince-Smith and Stells, Limited, of Keighley, Yorkshire, England, has enabled the centrifugal spinning of "dry" yarns such as worsted, woollen, cotton, rayon staple and silk. The spinning of "wet" yarns has been practised for some time, notably in the production of rayon, but one of the difficulties before the centrifugal spinning frame was made was to prevent the collapse of the "dry" cake into an unusable mass once the spinning container or pot ceases to revolve.

The principle upon which the P.S.C. system operates is: Rotating spinning container is driven from the top and is open at the bottom. Yarn issues through a central vertically traversing tube into the container where it is wound by centrifugal action. When the requisite length of yarn has been wound an automatic doffing operation is initiated, an empty bobbin being raised into the container with the simultaneous retraction of the traverse tube and the stopping of the rollers feeding the yarn. The yarn from the centrifugal container is then wound on to the stationary bobbin, which is afterwards lowered and tilted forward ready for doffing. After the above sequence of operations, the machine automatically commences to carry out the spinning sequence again.

•

A Tip For Motorists.—Frequent washings and occasional applications of a film of light lubricating oil (about S.A.E. 10-W) are all that are necessary to preserve the bright look on chromium plated automobile bumpers, according to a statement released by the American Electroplaters' Society. Wax body finish compound also may be used although these materials are somewhat less effective than oil.

The following process of preserving the plating is recommended. Dry the surface thoroughly and wipe over with an oil dampened cloth three or four times during the winter months and at least once during the summer months. Excess oil should be wiped off with a dry cloth so that the lustre of the bright work is not impaired. When corrosion is already visible on the plating it is recommended that it be rubbed with a damp cloth and a mild scouring powder may be helpful. After rinsing and drying an application of oil will fill the pores in the electroplate and retard further rusting or corrosion.

•

GUNITE LININGS PROTECT AND STRENGTHEN!

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STEEL TANKS
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GUNITE AND WATERPROOFING LIMITED
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Special cements and aggregates for each job. Recommendations carefully prepared to meet all problems.

Appointments and Transfers

G. R. Ball.—Gordon R. Ball, vice-president and general manager and director of the Bank of Montreal has been elected a director of International Nickel Company of Canada Limited.

•

John W. Brophy.—John W. Brophy, is acting general manager of General Motors Diesel Limited, London, Ont. He has been with General Motors for more than twenty years.

Formerly director of production control and purchasing, Mr. Brophy's new appointment was announced by C. E. Wilson, president of General Motors Corporation, following the federal appointment of E. V. Rippingille, Jr., as director of the aircraft division of the Department of Defence Production. Mr. Rippingille will continue as president of the General Motors Diesel Ltd.

•

H. W. Royl.—H. W. Royl of Montreal has been appointed works manager of the Sperry Gyroscope Company of Canada Ltd. He will be in charge of Montreal manufacturing operations.

Mr. Royl came to Sperry from the Montreal Transportation Commission where he has been superintendent of maintenance since 1949.

•

Ingersoll-Rand Changes.—Canadian Ingersoll-Rand Company Limited announce that their Winnipeg branch and territory has been added to the Company's "Central Region" under the direction of T. M. Parr of Toronto. This central region now includes the Toronto, Kirkland Lake, Timmins and Winnipeg branches.

•

Goodrich Managers.—H. P. Hawkins, general manager, industrial products sales division and general manager of the B.F. Goodrich Rubber Company of Canada, Limited, has announced the following appointments. Lorne W. Holden and John Hall, formerly of the sales staff, have been named district man-

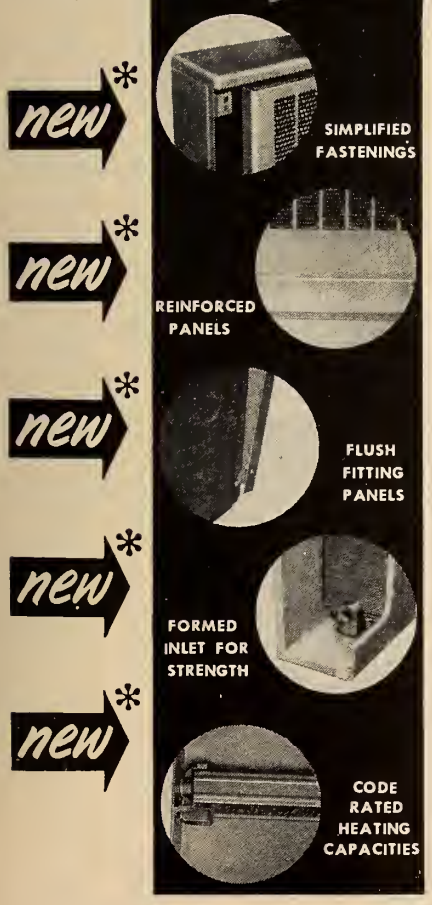
THIS IS CONVECTOR-RADIATOR MONTH

TO MARK THE FIRST YEAR OF THE NEW

TRANE

CODE RATED

CONVECTOR-RADIATORS



A COAST TO COAST EVENT

THANKS TO YOU!

This is Convector-radiator month. This announcement is made by TRANE in recognition of the acceptance of the new Trane Code-Rated Convector-radiator introduced to Canada one year ago. Thanks to you and all our friends throughout the building industry, TRANE has maintained its commanding position of leadership in this field.

Trane Code-Rated Convector-radiators have proved to be easier to select and specify. Ratings are accurate and dependable, set to an internationally recognized standard. Major installations across Canada have proved their superiority in operation.

Tradesmen like the easier installation and trouble-free assurance which positive ratings assure. The ultimate user likes the added heating satisfaction and economy which Code-Rating has made possible.

Specify Trane Code-Rated Convector-radiators with confidence . . . this month—**and every month !**

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Toronto, Ont.
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Winnipeg, Man.
Hargrave Street

Quebec, P.Q.
711 Price House

Hamilton, Ont.
63 John Street South

Regina, Sask.
408 Westman Chambers

Montreal, P.Q.
5303 Western Avenue

Windsor, Ont.
52 Chatham Street West

Calgary, Alta.
130-7th Avenue East

Ottawa, Ont.
86 Gloucester Street

Kirkland Lake, Ont.
74-4th Street

Vancouver, B.C.
1628 West 4th Avenue

London, Ont.
Wyatt Building, Room 10B
294 Dundas Street

Edmonton, Alta.
612 Northern Hardware Building

agers of the Montreal and Vancouver posts respectively. Their headquarters will be at the B. F. Goodrich branches in those centres.

●

Canada Paper Promotions.—Canada Paper Company Limited has announced the following promotions. A. J. Philip, who for the past eighteen years has been mill manager at Windsor Mills, Quebec, has been promoted to the position of assistant general manager of the company. He will continue to reside at Windsor Mills. Earl Rice, who for the past six years has been assistant mill manager at Windsor Mills, replaces Mr. Philip as mill manager.

●

Minneapolis-Honeywell Appointments.—Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Ontario, has made these following appointments. Norman K. Smith, manager of the Calgary branch office since 1947, has been appointed branch manager at Montreal. He will be responsible to Ivan McDonald, Eastern Canada regional manager.

Phillip M. Meis, commercial division salesman in the Vancouver office, has been appointed branch manager at Calgary. John Penny, heating controls salesman in the Toronto office, has been transferred to the Vancouver office where he will represent the heating controls division in the Vancouver territory.

●

Dominion Rubber Changes.—D. J. Mackenzie, recently appointed general manager of the export division, Dominion Rubber Company, has succeeded J. A. Porteous, who has been named director of sales, United States Rubber International, Division of United States Rubber Company, New York.

Mr. Mackenzie started with the Company in 1927 in the Winnipeg branch. In 1942 he was appointed to the mechanical rubber goods division, Montreal, as commodity manager, which position he has held up to the time of his present appointment.

●

Vancouver Engine Works.—The De Laval Steam Turbine Company has announced the appointment of Vancouver Engineering Works, Ltd., as their exclusive representative in the Province of British Columbia. Vancouver Engineering Works, Ltd. has been established in the province of British Columbia for the past 22 years. They will handle products of De Laval Steam Turbine Company, including centrifugal pumps, centrifugal blowers and compressors, steam turbines, De Laval IMO rotary pumps, speed reducers and flexible couplings.

Specialized engineering projects and marine equipment will continue to be handled by the De Laval organization in Trenton.

●

Address Change. — Dominion Flow Meter Co. Limited and Diesel Power Limited have moved to a new address in Toronto—it is 185 Eileen Avenue, Toronto 9, at the junction of St. Clair Ave. and Scarlett Road.

●

D. M. Morrison.—Dr. D. M. Morrison, M.B.E., has been named director of petroleum division, Department of Defence Production. Dr. Morrison was formerly manager of the Montreal refinery of the Shell Oil Company of Canada.

Dr. Morrison was granted leave of absence by Shell earlier this year to join the Government petroleum board.

●

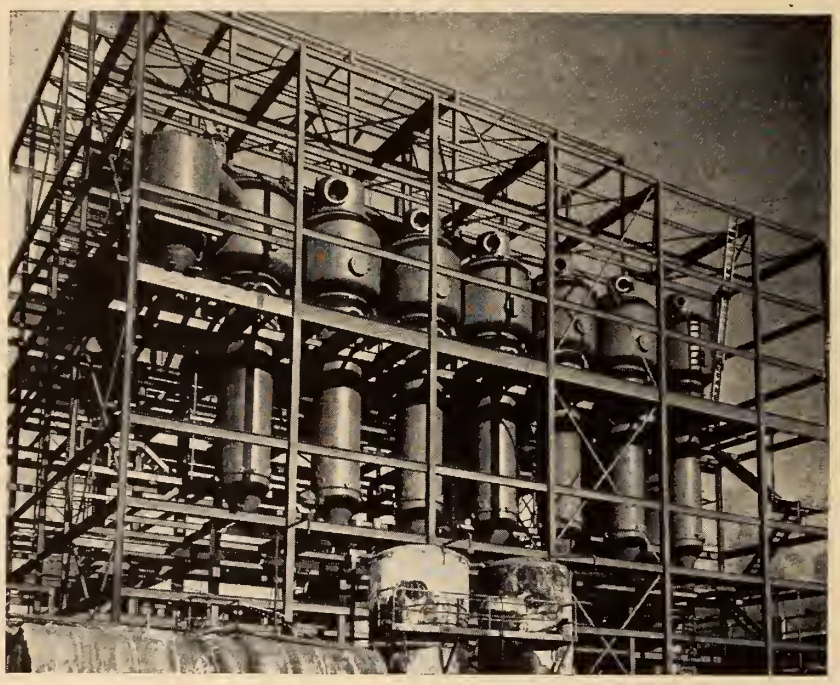
New Westinghouse Positions.—Canadian Westinghouse Company Limited has appointed Roy L. Brown to the post of general manager of two new divisions to be known as supply products divisions. Mr. Brown will undertake these new duties in addition to those of vice-president and general manager of the Canadian Westinghouse Supply Company.

The supply products division will consist of the company's lighting division, which recently moved operations from Hamilton to Granby, Quebec, and to the construction industry division. The latter will embrace all operations connected with panelboards, bus duct, low voltage switchgear, etc. Headquarters of this division are at Etobicoke, Ont.

Serving under Mr. Brown as managers in the newly created divisions will be S. C. Smith and W. A. Eskil. Mr. Smith will be in charge of the lighting division and Mr. Eskill of the construction industry division.

W. Millar has been named manager of the lighting division's Vancouver department.

H. H. Lang, manager of the service department, has named H. O. Hewitt as district service manager in the Vancou-



SEPTUPLE EVAPORATOR

Toronto Iron Works have built an enviable reputation throughout Canadian industry for steel plate products of superior workmanship and dependability. This Septuple Swenson Evaporator was fabricated and erected for one of the leading companies in the pulp and paper industry and is an excellent example of T.I.W.'s diversified ability in steel plate fabrication.

To meet exacting specifications, T.I.W. maintains the highest engineering standards and up-to-date equipment for completely fabricating and erecting steel plate and alloys. You can depend on Toronto Iron Works . . . steel plate specialists since 1907.

THE TIW STEEL PLATE PRODUCTS

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ver district, and A. Hopkins as assistant district service manager in the Toronto district. W. W. Brumby has been named assistant district service manager in the Winnipeg area.

•

G. M. Egoff

Sheldons Executive Changes.—W. D. Sheldon, Jr., M.E.I.C., president of Sheldons Engineering Limited, Galt, Ontario, has announced the following executive changes. J. P. Stuart, general manager, has retired after 47 years of service. When the firm was incorporated under

A. T. Thom

the name of Sheldons Limited in 1906, Mr. Stuart was appointed secretary-treasury, a position which he held until 1934 when he became president. In 1949 Mr. Stuart sold out his interests to Sheldons Engineering Limited and resigned as president but remained with the new organization as general manager. He will continue to serve the Company in an advisory capacity. G. M. Egoff has been appointed managing director. He has been with the Sheldon's for fourteen years and, since 1949, has been secretary and director. A. T. Thom is now a vice-president. He is also president of the Waterloo Manufacturing Company Limited and Construction Machinery Limited.

•

W. G. Miller.—William G. Miller, an engineer with more than 25 years' experience in locomotive and oil refining equipment production has been elected vice-president and a director of Montreal Locomotive Works, Limited.

•

C. E. Begin.—C. E. Begin is now acting district manager of the Montreal office of Ferranti Electric Limited.

•

Defence Production Appointments.—The following appointments have been made in the Department of Defence Production. Dr. Donald M. Morrison has succeeded Dr. O. B. Hopkins as head of the petroleum division. E. P. Rippingille, Jr., president of General Motors Diesel Ltd., London, Ontario, has been appointed director of the aircraft division. He succeeds Air Vice Marshall F. S. McGill, who is returning to Dominion Oilcloth and Linoleum Co. Ltd.

•

Reliance Electric Changes.—Reliance Electric & Engineering (Canada) Limited has announced the following appointments. J. M. Smeaton is the district manager in Welland. V. E. North is in charge of the Toronto dis-

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Spaciousness... impressive appearance... functional planning... low building costs — all these are accomplished by glued laminated timber members of Timber Structures of Canada, Ltd.

For here is functional construction at its best. Architects appreciate the freedom of design and the striking effects obtained with this truly modern material; and with the glued laminated members supplying both architectural embellishment and primary structural members, the resulting low final cost is welcomed by the school administrators.

Glued laminated members are formed of kiln-dried material, "shop grown" to the exact shape specified by the designer. Stronger than sawn timbers of equal size, they remain free from dimensional changes and seasoning blemishes. Choice of finish includes hand rubbing, paint and stain.

A brochure entitled "Engineering in Wood for Modern School Buildings" outlines some of the uses of engineered timber in construction of classrooms, gymnasiums, field houses and other school buildings. A copy is yours for the asking. See your nearest Timber Structures office, or fill in and mail the coupon.

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FACTORIES & WAREHOUSES:
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Canadian International Paper
N.B. Pulp & Paper Co.
Imperial Tobacco Co.
Coca-Cola Ltd.
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Superitest Products
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Power Food Markets
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Sacred Heart College, Sudbury, Ont.
Ascension Convent, Chicoutimi, P.Q.
Malartic School
King George V School, Chippewa, Ont.

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trict and A. W. Ludlam of the Montreal district.

Reliance Electric & Engineering (Canada) Limited was created through the purchase of the Commonwealth Electric Corp. Ltd., by the Reliance Electric & Engineering Company of Cleveland, Ohio, about one year ago. These appointments of new district managers represent steps in a programme of reorganization and expansion.

●

F. A. Pankhurst.—Canada Wire & Cable Co. Ltd., has appointed F. A. Pankhurst general works manager. Mr. Pankhurst's new duties will include supervision of the factories at Leaside, Montreal East, Quebec and Vancouver. He has been associated with the Company for the past twenty years.

●

F. A. Pankhurst

H. F. Stearns.—H. F. Stearns has been elected president of Horton Steel Works Limited. He succeeds W. R. Manock, M.E.I.C., who retired on December 31st, 1951. (See personals January, 1952).

●

D. A. Taberner.—D. A. Taberner has been appointed sales manager, bar mill products division, Steel Company of Canada Limited.

●

K. A. Blatherwick.—K. A. Blatherwick has been named managed of Canadian General Electric Company, Three Rivers, Que., office. Mr. Blatherwick is well known in the province of Quebec as he has been attached to the Sherbrooke area for a number of years.

●

Avro Changes.—Avro Canada has made the following changes. Edgar H. Atkin, formerly chief engineer is now technical director. James C. Floyd, formerly works manager has been made chief engineer and Dennis E. Wiseman, formerly production planning manager is works manager. Fred T. Smye, a director of the Company, is now giving his full attention to production and development and has been made general manager of the aircraft division

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Nordberg Radial Engines.—Nordberg Manufacturing Co., Milwaukee 7, Wis., offer copies of a beautifully produced publication devoted to "Nordberg radial engines—gas—oil—duafuel."

Apart from the technical information, the publication is so well printed that it is recommended to readers of the *Journal*. Many of the pages are printed on cellophane—in colour—to show "what's under the surface". For copies of this publication write to the Nordberg Company and ask for "Trans-Vision Bulletin No. 184".

●

Nickel Bulletin.—Two new bulletins have been issued by the technical service section of International Nickel's development and research division as first aids in the recovery of strategic metals from scrap to stretch existing supplies of these materials.

The first of the bulletins describes some easily made tests with simple equipment for identification of nine wrought white metals and alloys used widely in fabricating shops. The second bulletin is more comprehensive, and outlines procedures for identifying more than 125 metals and alloys. Write to International Nickel Company of Canada Limited, 25 King Street W., Toronto, and ask for "First Aids in Scrap Salvage" and "Rapid Identification of Some Metals and Alloys".

●

Civil Defence Film.—An important civil defence film "And a Voice Shall be Heard" is now available from General Electric Company for any group interested in this important work. Write to the Company at 212 King Street West, Toronto to arrange a booking.

●

Lamp Ballasts.—Two new publications on fluorescent lamp ballasts, available from Canadian General Electric Company, Limited, are of particular interest to electrical engineers, fixture manufacturers and consulting engineers.

The first, a 20-page three-colour booklet (GEA-5731) explains how a fluorescent lamp works and the part the ballast plays in its operation. Of a more technical nature is the second publication GEA-5672 which deals with the new system of "sound-rating" ballasts. This four-page, two-colour brochure describes how GE ballasts are classified according to the amount of natural hum

Did you remember to note the

ANNUAL MEETING

dates?

MAY 7-8-9 at VANCOUVER, B.C.

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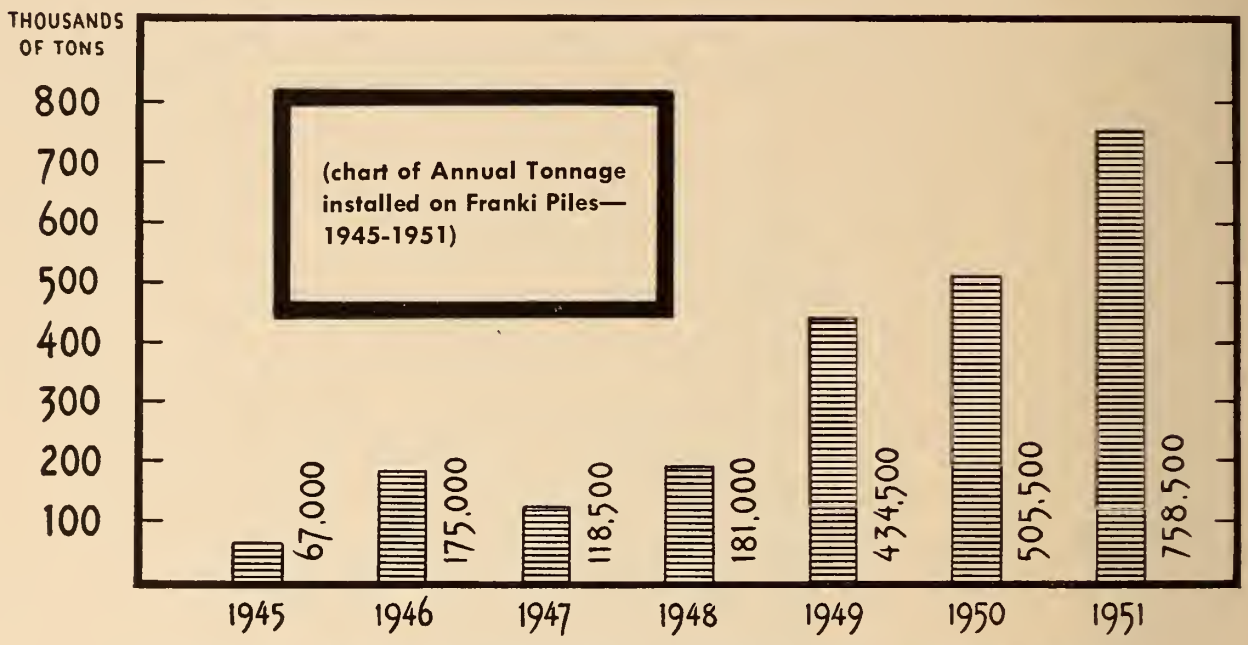

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Proof that Franki piles carry a "lot of weight" with Architects, Engineers and Contractors everywhere in Canada is clearly shown by the Annual Tonnage chart, above. New construction supported by Franki piles in 1951 amounted to 758,500 tons — almost 12 times as much as in 1945.

This phenomenal growth in the demand for Franki piles is due to the unique driving and concreting procedure, the high bearing capacity and absolute adaptability of Franki piles to widely varying sub-soil conditions, as well as the Franki policy of courtesy, dependability and service.

For safe, efficient foundation work on any job, be sure to investigate the Franki Methods.

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they emit. It also explains how these ratings can be put to use by fixture manufacturers and others. Copies may be obtained from any GE office.

●

Soil Conditioner.—A synthetic chemical soil conditioner, the first product of its kind to achieve effective and economical control of rain erosion, has been developed by Monsanto Chemical Company. The trade name is "Krilium". It is a synthetic polyelectrolyte.

Krilium is expected to have wide application in controlling slope erosion problems created by major earth-moving construction projects, including highway and railway constructon, housing projects and construction and maintenance of military installations. In addition, it shows promise in the control of spot erosion problems in productive agricultural areas. Write to Monsanto (Canada) Ltd., 425 St. Patrick St., Montreal, for descriptive literature.

●

Diesel Railway Traction.—Davey, Paxman and Company Limited, Colchester, Essex, England, offer *Journal* readers copies of a reprinted article "Diesel Railway Traction".

●

Soil Pipe & Fittings. — Warden King Limited, 2104 Bennett Avenue, Montreal, have available copies of catalogue No. ADM-5114 "Soil Pipe and Fittings". Apply to the manufacturer for copies.

●

Bepco Products.—No. 2 of Volume X of The Bepco Journal contains a comprehensive survey of the products distributed in Canada by this company. For copies apply to Bepco (Canada) Limited, 4018 St. Catherine Street West, Montreal 6, Que.

●

Spray Nozzles.—Up-to-date information on Non-Clogging Spray Nozzles for cleaning all kinds of materials, screens, fruits, vegetables, etc., is given in a new 4-page illustrated folder No. 2386 released by Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8.

The folder shows installation pictures and how simply the nozzles can be applied. Tables give dimensions of nozzles for pipes of 1 to 3 inches diameter and the capacity in gallons per minute through orifices of 5/32 to 1/2 inch diameter at pressures of 20 to 100 lbs. per square inch. Apply to the manufacturer for copies.

●

"Cinch" Anchor Booklet.—Canadian "Cinch" Anchoring Systems Limited, 455 Craig Street West, Montreal offer a highly informative and well produced booklet "Cinch Expansion Anchors".

The booklet is offered and designed to illustrate and explain in a brief and concise manner the principals, design features and installation and uses of Cinch expansion bolt anchors and drive-sleeve anchors. Copies may be obtained from the Company.

●

Grinding Mills.—A most comprehensive collection of engineering data on grinding mills for rock products, cement, chemical and mining industries is contained in a new 44-page bulletin recently released by Canadian Allis-Chalmers (1951) Ltd.

Generously illustrated, the bulletin suggests points to consider when choosing a grinding mill, gives the basic design of the different types of mills, describes grinding circuits, and furnishes equations and tables for use as a guide for mill selection, along with closed and open circuit grindability indices unobtainable from any other source.

The six separate types of grinding mills—rods, pebble, Ballpeb, ball, preliminator, and Compeb mills—together with data on their parts, specifications, dimensions, and capacities are all included in the bulletin. Address requests to Canadian Allis-Chalmers (1951), P.O. Box 37, Montreal, Que., and ask for bulletin No. 07B6718A.

●

Light Dimming Equipment. — The Superior Electric Co. Ltd., Bristol, Connecticut, offer a bulletin intended to familiarize users of light dimming equipment with the new line of redesigned dimmers they manufacture. Write to the manufacture and ask for bulletin D651P.

●

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Book for Children.—Canadian Westinghouse Company Limited, Hamilton, Ont., has released a special booklet prepared for school children to gain further knowledge of the industry. The publication is called "The Friendly Giant". It is available in both French and English. Journal readers are invited to apply for copies for their own children or for other school children.

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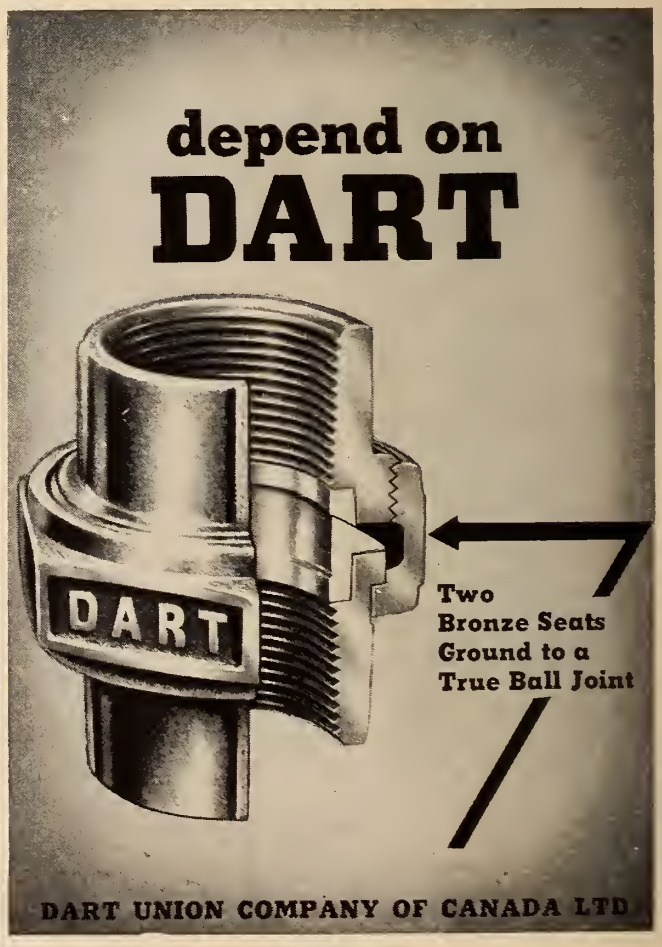

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THE INDUSTRIAL GAS TURBINE

by

A. Kellersberger, M.E.I.C.,
Brown Boveri (Canada) Ltd.,
Montreal.

A paper presented before the Edmonton Branch of The Engineering Institute of Canada on March 13, 1951, by Mr. Kellersberger, and later presented to the Montreal Branch of the Institute, on November 1st, 1951, by Mr. H. Lusser, also of Brown Boveri (Canada) Ltd.

The purpose of this paper is to give a practical review of development, characteristic qualities and operational experience of the gas turbine, for power generation and industrial applications. While observations are based mainly on developments and experience gained with Brown Boveri gas turbine units, the author is fully aware of the many contributions being made to gas turbine development by the increasing number of firms actively interested in this prime mover.

The gas turbine is a prime mover which inspires the engineer's mind more than any other. The main reason for the continuing interest the gas turbine finds in engineering circles all over the world is its simplicity, and the practically unlimited applications it promises. The open cycle gas turbine to which this discussion will be restricted is a completely self-contained prime mover. It can be applied as a driving engine for electric generators, pumps, blowers and compressors and as a power plant for aircraft and locomotives.

Depending on the cycle refinement, it has been built for thermal efficiencies from 17 to more than 30 per cent. These figures are based on the lower heat value of the fuel. Units with lower efficiencies can be used as cheap stand-by plants, while units with better heat rates can compete favourably with base load steam plants of the corresponding size.

Gas turbines have a short starting time. A single-shaft unit of about 5,000 kw can be started in about five mins. from cold to full load, which is an excellent feature for a stand-by plant. Larger units, such as the 27,000-kw plant installed in a Swiss power house, are started within 30 to 40 mins. from cold to full load and require only two operators for this procedure.

Gas turbines burn a wide variety of fuels, ranging from the heavy residuals such as Bunker C oil, to the various gases such as natural, refinery and blast furnace gas. The cooling water requirements are small. A 5,000-kw single shaft gas turbine without intercooling of the air uses as little as 90 gpm. for its oil cooler. An equivalent condensing steam plant would require approximately 5,000 gpm. for the condenser alone. This advantage cannot be over-emphasized for applications in arid areas.

Basically, the gas turbine is a simple machine. It consists of a compressor, a combustion chamber, the driving gas turbine and only few accessories. The compressor draws in atmospheric air and delivers it to the combustion chamber at a pressure of about 60 psig. Only a small part of this air is necessary for burning the fuel. By far the greater part is admitted alongside the walls of the combustion chamber for the purpose of cooling the combustion gases from their initial temparature of 3,300-3,600 F. down to the temperature admissible in the turbine. The gas turbine exhausts the gases directly into the atmosphere.

The net output available at the blower coupling is equal to the power produced by the gas turbine less the power absorbed by the compressor. If we assume, for example, that the turbine would produce 1,000 kw and that the blower would require 700 kw, a net output of 300 kw. would be available.

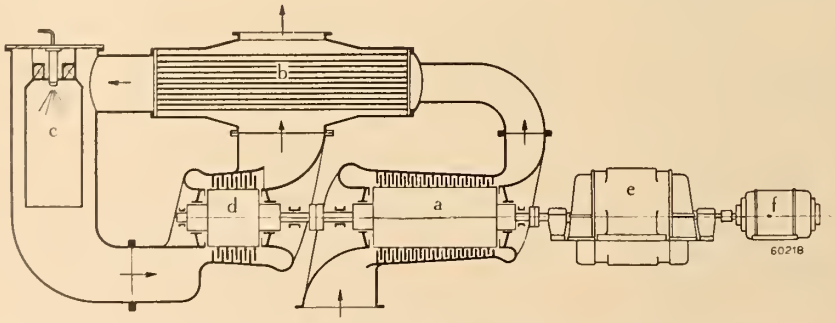


Fig. 1. Diagram of single shaft gas turbine with heat exchanger.

Early Developments

The fascinating features of gas turbines have attracted inventors in Britain since the 17th and 18th century. Thanks to the engineering knowledge acquired at the end of the last century, it was finally brought out of the blue print stage into the field of actual manufacture. The early attempts in the U.S., France and Germany were not very successful, since the turbines could hardly drive their own blowers. The low efficiencies of the component parts and the low gas admission

temperature were probably to blame for this failure.

As early as 1909, Brown Boveri had built an explosion type gas turbine of 1,000 hp. for Dr. Holzwarth, a German scientist. The unit developed only a net output of 200 hp. and was never put into continuous operation. The development of exhaust gas superchargers for diesel engines and the development of axial blowers to high efficiencies opened the way for the first industrial applications of the open cycle gas turbine in the early 30's.

Cycle Arrangements

We will now discuss the basic types of open cycle gas turbines and their main characteristics. Although only three basic types can be distinguished, a nearly endless number of combinations between these types can be built.

The basic single shaft unit consists only of a turbine, a blower and a combustion chamber. It is recommended for small stand-by plants and for installations where, due to cheap fuel, a high efficiency is not considered an important factor. To be economical, the size of such a unit should be at least 1,300 kw.

This single shaft gas turbine with heat exchanger, Fig. 1, is practically the same as the preceding. The only difference is the additional heat exchanger, in which some of the exhaust heat is recovered and used for heating the compressed air. With this type, the thermal efficiency can be improved approximately from 17 to 22 per cent.

The double shaft gas turbine, Fig. 2, is usually recommended for the drive of electric generators with capacities over 8,000 kw requiring higher efficiencies and favourable partial load characteristics. This arrangement consists of two shafts each driven by its own gas turbine, and provides three additional refinements:

(1) Instead of a single blower, two or three blowers are connected in series and the compressed air is cooled between each of them. Less power is absorbed by the blower plant since the compression characteristic approaches the ideal isotherm line.

(2) Instead of a single gas turbine, a two stage expansion with intermediate reheat, increasing the efficiency of the cycle is used. The hot combustion gases leaving the H.P. combustion chamber are expended in the H.P. gas turbine to an intermediate pressure. After reheating close to the initial temperature in the L.P. combustion chamber, the gases are expanded further in the L.P. gas turbine.

(3) Each shaft can be operated at its appropriate speed. One of them drives the alternator at constant speed. The speed of the other is adjustable, in order to provide optimum efficiency of the blowers at any partial load. Favourable partial load efficiences of the unit can be obtained with this set up.

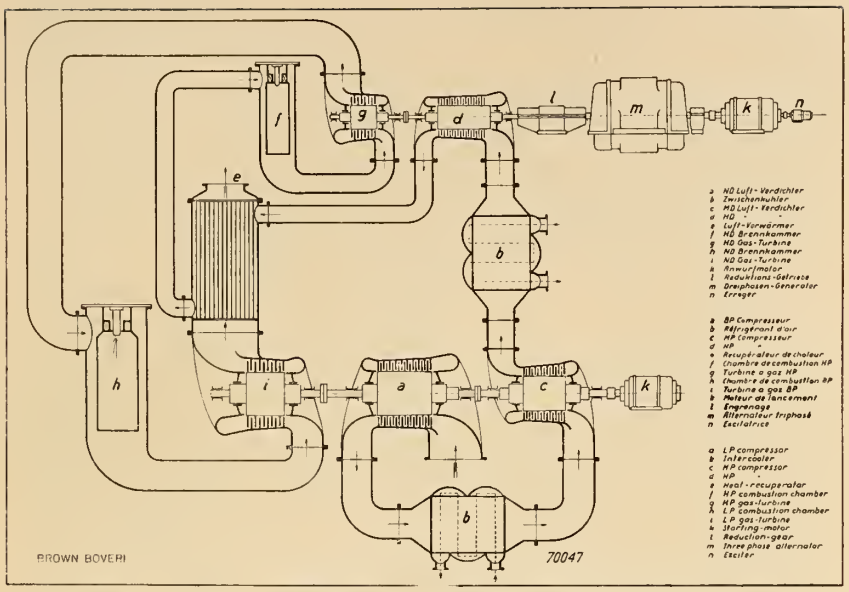


Fig. 2. Diagram of double shaft gas turbine with intercoolers.

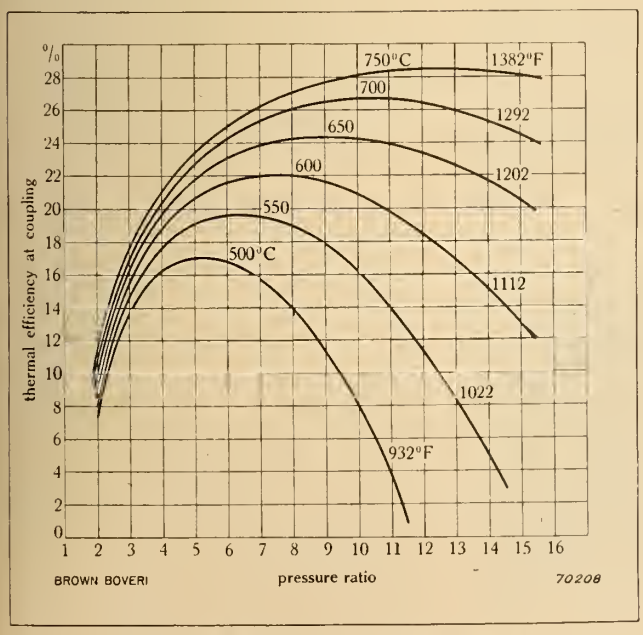


Fig. 3. Thermal efficiency versus pressure ratio for various gas inlet temperatures.

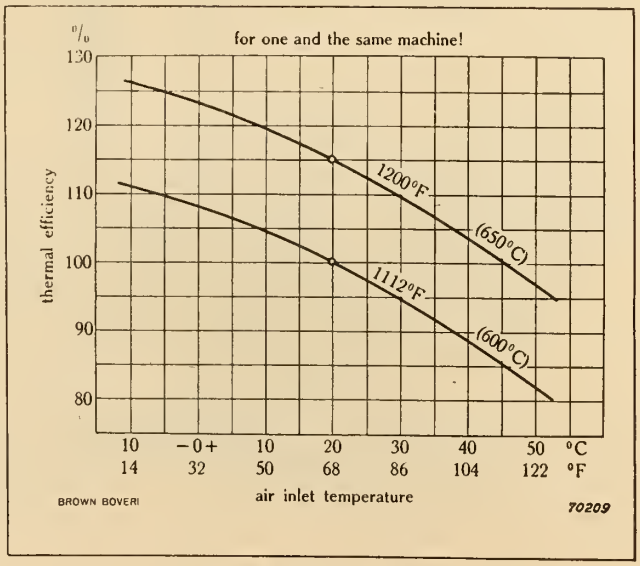
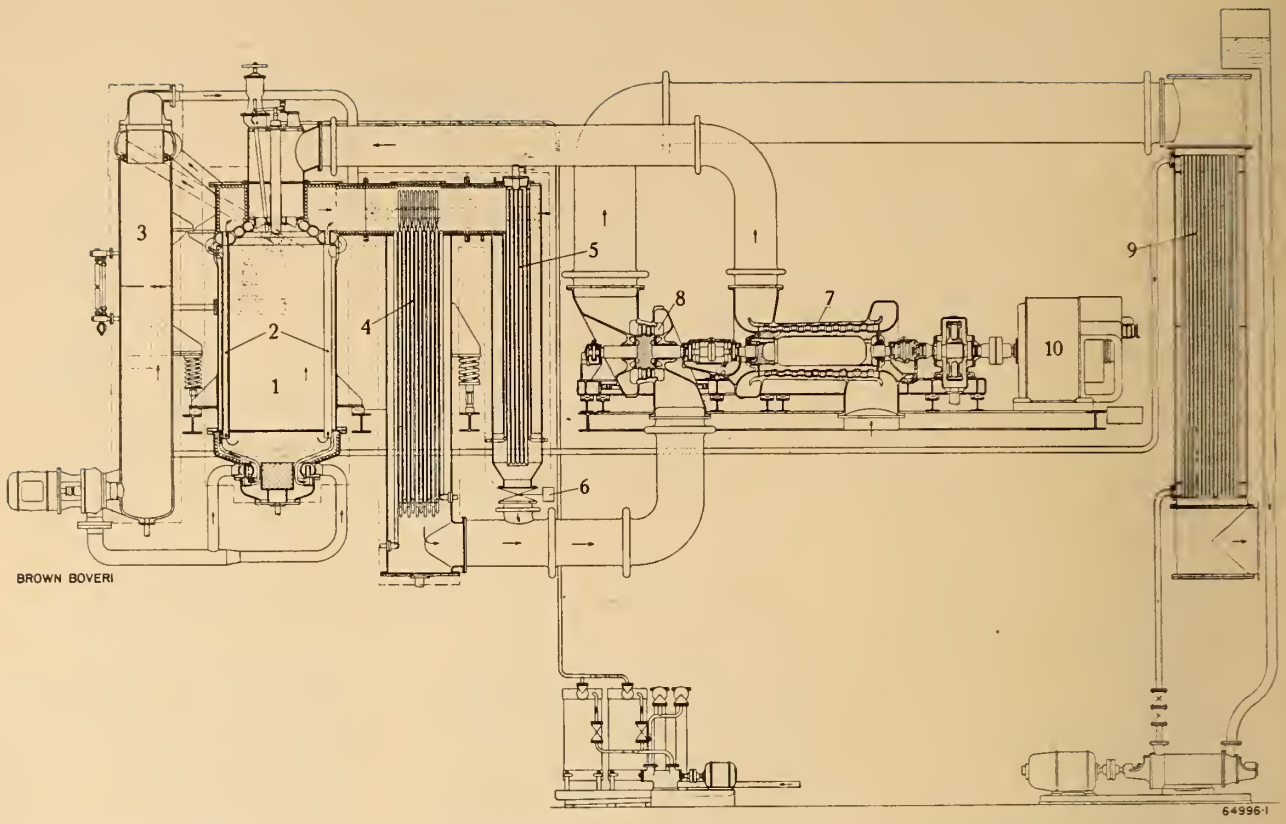


Fig. 4. Thermal efficiency versus air inlet temperature.



1. Combustion chamber.
2. Evaporator elements.
3. Steam separator.
4. Superheater.
5 & 6. Regulator for the superheat.
7. Air compressor.
8. Gas turbine.
9. Economizer.
10. Motor for starting and regulating.

Fig. 5. Diagram of a Velox boiler.

Characteristics

All types of open cycle gas turbines have the following characteristics:

(1) The thermal efficiency and net output increase when the gas inlet temperature to the turbine is raised.

(2) Efficiency and net output increase or decrease with the variation of the air inlet temperature.

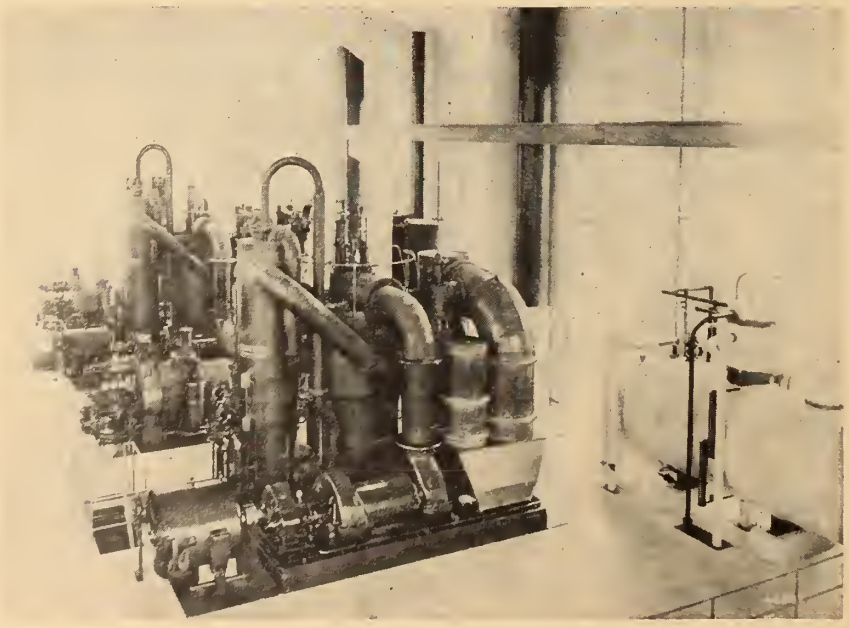


Fig. 6. Velox steam plant.
2 x 60,000 lbs./h. Velox boilers with respective turbo alternator sets.

For various gas inlet temperatures, Figure 3 shows the thermal efficiency of the unit against the pressure ratio of the blower. Two facts can be observed from this diagram:

(1) The thermal efficiency does not depend only on the gas inlet temperature, but on the pressure ratio as well.

(2) The maximum gain in thermal efficiency when increasing the temperature can only be obtained when raising the pressure ratios accordingly.

If we increase, for example, the temperature from 932 deg. F. to 1,292 deg. F. without altering the pressure ratio, the efficiency may increase from 17 to 23 per cent, that is, by 35 per cent. On the other hand, an efficiency of 26 per cent, corresponding to an increase of 55 per cent, can be obtained when raising the pressure ratio from 5.2:1 to 10.5:1. The possible increase of the pressure ratios require large and expensive blower plants. For this reason, actual single shaft installations are usually operated at pressure ratios between 4:1 and 5:1, which is below the optimum for the respective termperatures. Figure 4

shows the variation of the thermal efficiencies against the air inlet temperatures.

Review of Installations

We would now discuss chronologically, some of the more interesting gas turbine installations.

Figure 5 shows the first application of the gas turbine as a charging set for oil and gas fired Velox boilers. Velox boilers are steam generators with forced feed water circulation and supercharged combustion. They feature a very compact design and may be started in about five minutes from cold to full load. The combustion gases enter the gas turbine at 950 to 1,050 deg. F. and are expanded to atmospheric pressure. The turbine drives the axial flow compressor delivering the combustion air at 25 to 35 psig.

Figure 6 shows two 60,000-lb.-per-hr. Velox boilers installed in 1939 in a refinery in South America. The boilers and turbines are located in the same room. This layout provides self-contained units and requires a small staff. Records available to the end of 1948 show a total operating time of about 82,000 hours for each of the units. Their operating factor is about 95 per cent. The boiler availability is even higher since the units are shut down for 12 days every year for maintenance work in the refinery.

Figure 7 shows the first of 26 gas turbine driven blower sets supplied to the Sun Oil and the Socony Vacuum Oil Company for catalyst regeneration in the Houdry cracking process. Compressed air at about 35 psig. is used to burn the carbon deposits on the catalyst. The hot exhaust gases from the catalyst are expanded in the gas turbine which supplies the power for the 40,000 cfm. blower. Depending on the state of the process excess power may be available and electric power may be generated in the alternator at the end of the shaft.

The gas turbine using available waste heat made the Houdry process economical. This is a classical example of the use of gas turbines in the chemical and oil industries. Six of these units, the first in 1936, were delivered from Switzerland. The remainder were manufactured by Allis-Chalmers to Brown Boveri designs. It should be added that the seven units installed at the Marcus Hook Refinery of the Sun Oil Company have operated during approximately 22,000 days, and their operating factor is as high as 98 per cent.

Figure 8 shows one of the units with the upper half of the casing removed. The five stage gas turbine and the multi-stage axial blower can be observed.

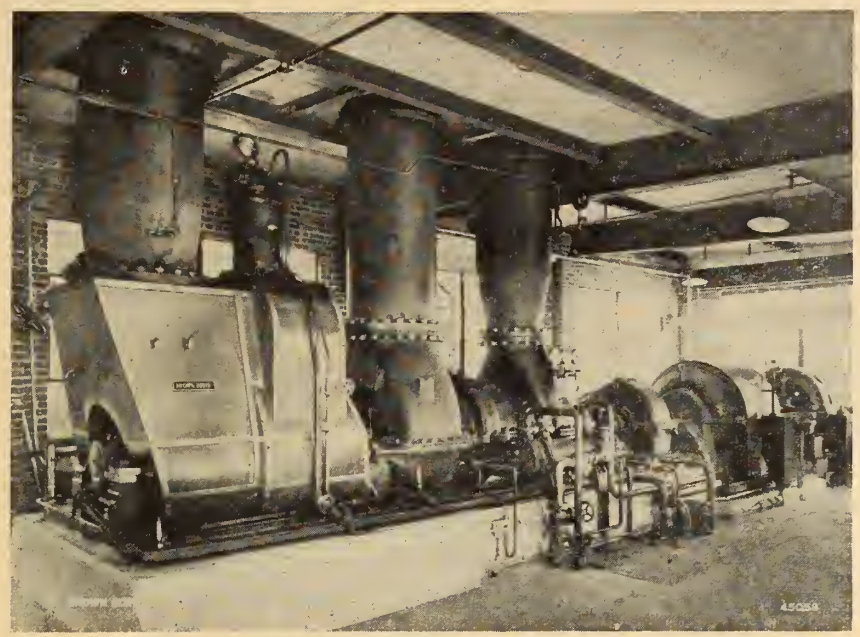


Fig. 7. A gas turbine blower set for the Houdry cracking process.

In the following review are shown some examples of gas turbine generating sets. On the whole, 22 plants with a total capacity of more than 120,000 kw. have been installed or are at present on order. 13 plants with about 80,000 kw. are in operation.

The first gas turbine ever built exclusively for power production was installed in 1939 in a bomb proof tunnel, and serves as a standby and peak load unit in a Swiss city of about 30,000 people. The plant is a single shaft unit without heat exchanger and is completely self-contained. It starts automatically if the power supply to the city fails. The power required for the starting motor and the oil pump is supplied by a small diesel generator set. The unit is operated with diesel oil and has a net thermal efficiency of 17 per cent when operated at a turbine inlet temperature of 1,020 deg. F.

The modern gas turbine shown in Figure 9 is an example of the simplicity of these units. No additional rooms for accessories are required. The photo of this single shaft 4,000-kw. unit was taken from the turbine end, and shows the vertical combustion chamber very well. The alternator on the far end cannot be seen. All the instruments for starting and control are located in the two panels on the right hand side. This plant was put into operation in Peru, South America, in 1949. The unit is

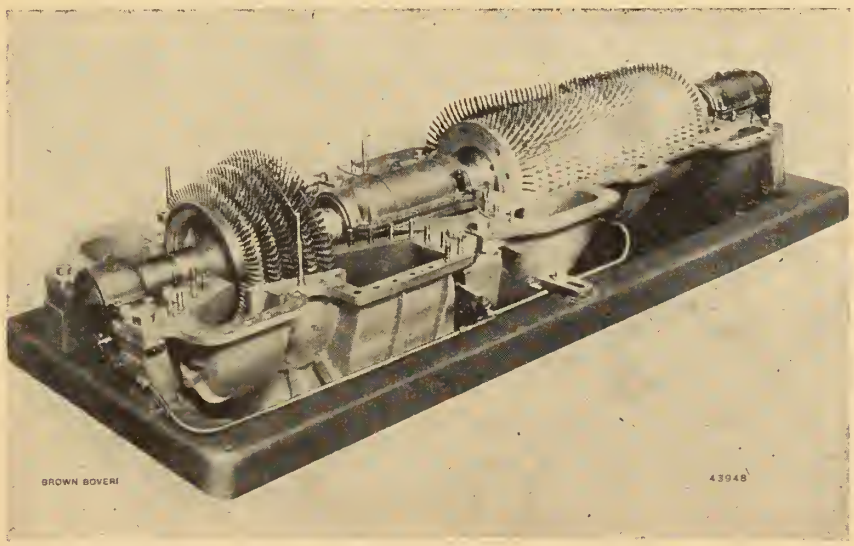


Fig. 8. Gas turbine blower unit with upper half of casing removed.

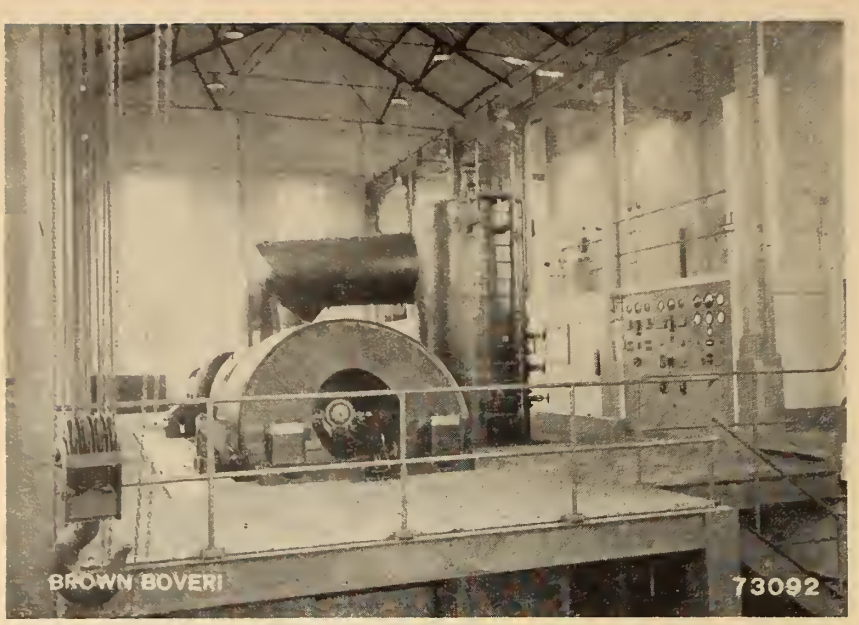


Fig. 9. A 4000-kw. gas turbine alternator set in Peru.

operated for 10 to 12 hours daily and covered 3,325 hours up to March, 1951.

Used in Latin America

In the power house of a cement plant in Venezuela, two 1,650-kw. single shaft units with heat exchangers are installed. There is a vertical combustion chamber, and four heat exchangers per unit are installed. The two machines are the only source of power available at the plant. Each of them operates alternatively during one month. A mixture of 40 per cent diesel and 60 per cent Bunker "C" oil is used. The units were put into operation in 1949 and each has served for more than 8,000 hours at 1,112 deg. F. inlet temperature without causing any trouble and no replacements in the turbines, combustion chambers and heat exchangers were made. An additional 5,000-kw. turbine burning natural gas is now on order.

A 10,000-kw. gas turbine unit of the two-shaft arrangement is installed in the City of Lima, Peru.

This unit is connected to a hydro electric system for compensating seasonable power shortages and for carrying peak loads. It is operated with diesel oil at 1,112 deg. F. and has produced 58,000,000 kwh. during 7,800 hours of operation at an average net efficiency of 24 per cent. During the first 90 days, the unit was started 120 times.

The starting tests shown in Fig. 10 have been made on a two-shaft 10,000-kw. turbine similar to the one at Lima, but without heat exchangers. This unit could be started in less than eight minutes from cold to full load when tested at the works, and over 40 starting tests were made. Curve 1 was the performance of the constant speed shaft, Curve 2 the speed of the variable speed shaft, and Curve 3 the load on the generator. Let us follow the starting procedure for the constant speed shaft 1. It was accelerated during 1.2 minutes to about 1,000 rpm. by the starting motor. At this speed the combustion chamber was ignited and more and more power was developed by the gas turbine. After about two minutes, a speed of 1,500 rpm. was obtained and the starting motor was taken off the line. The turbine accelerated the shaft further, and it reached the final speed of 3,000 rpm. after 5½ minutes. The generator was automatically synchronized and an output of 10,000 kw. was obtained after less than eight minutes from the time of starting.

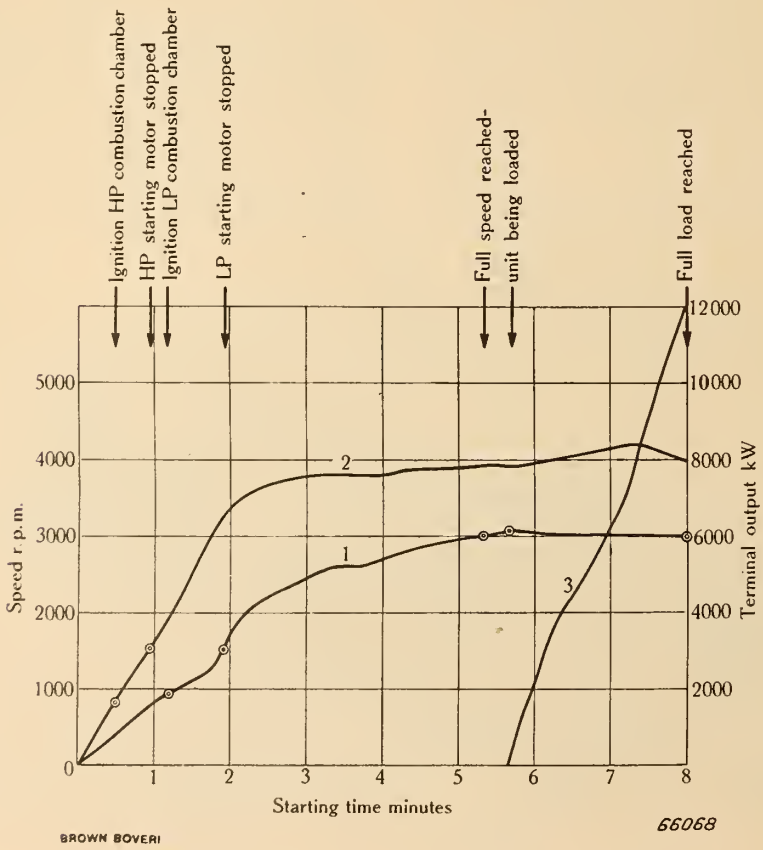


Fig. 10. Starting diagram of a 10,000-kw. gas turbine unit.

Installations in Europe

The world's largest gas turbine power station is located in Beznau, Switzerland, and is shown in Fig. 11. Two units are installed, one of 13,000 kw. and one of 27,000 kw. capacity. With the exception of a separate room for the heat exchangers, the units are completely self-contained and no boiler house with all its accessories is required.

Both units are installed in the same way. The constant speed H.P. shafts are to the right and the variable speed L.P. shafts to the left. On the three panels, all the instruments for starting and controlling the large unit are installed. The 13,000-kw. unit started operation in 1948, and has run during 6,000 hours since. The 27,000-kw. gas turbine came on the line a year later, and was operated for about 3,100 hours. Both units are connected to a

hydraulic system and operate mainly during the winter season, when the hydraulic power is short and the demand high. So far, they have supplied about 115,000,000 kwh.

The first gas turbine locomotive ever built had a capacity of 2,200-hp. It was put in operation in 1941, and has served for more than 7,000 hours on various main railway systems in Europe. The author had the opportunity to observe the performance of this locomotive on a run in Switzerland and was surprised at the simplicity of the controls and the smooth operation. He further noticed that the noise of this locomotive, although considerably higher in tone than that of the diesel, is not at all disagreeable. Another 2,500-hp. gas turbine locomotive, supplied to the Western region of the British Railways, has been running since early 1950, and the railroad is pleased with its performance.

Operating Experiences and Prospects

After this review of existing installations, it would be appropriate to discuss the various problems which were resolved during the period between 1939 and 1949. The understanding of these problems will help us to determine rules for the use of gas turbines. The difficulties which have arisen can be classified in three groups:

(1) Mechanical defects due to high temperatures.

(2) Ash deposits on the turbine blading of units using liquid fuels.

(3) Dirt deposits on the blower blading.

In order to explain the reasons for the first category of defects, we have to study briefly the behaviour of steel under the influence of high temperatures. Most of us are no doubt aware that the allowable temperature for a given stress depends mainly on the life expectancy for which the machine is designed. A determined elongation can be attained in a short period if high temperatures are applied or in a comparatively long period when the material is subjected to lower temperatures. Thus it is obvious that the design of a jet engine with a short life expectancy will be different from the layout of an industrial turbine which is expected to operate for 100,000 hours and more.

When the design of turbines for 1,100° F. was first undertaken, wide experience with heat resistant steels was available at the comparatively moderate temperature of 950 deg. to 1,000 deg. F. The development of these units for higher temperatures was a step into a new field, and it is not surprising that unforseen problems occurred after a considerable length of operation.

The standard blade type used continuously in the past proved insufficient for the higher temperature. Exhaustive tests were carried out, and it was observed that the special heat resistant steels have a strong notch sensitivity at high temperatures. A new blade root was developed and gas turbines already in operation were rebladed. The new design proved dependable during several thousand hours of service.

The second category covers all problems experienced with the burning of heavy liquid fuels such as Bunker C oil. It has been observed that the ashes of liquid fuels form deposits on the blading of turbines, which would lower their efficiencies if they were not washed out at regular intervals. The time between washings depends entirely upon the ash content of the fuel. To assure easy cleaning, the ashes have to be water soluble.

Washing devices have been developed, which allow washing the turbine without opening the casing. The process requires a shut-down of a few hours, the actual washing of the turbine requiring about one hour. The turbine has to be cooled down to about 210° F. before injecting the water. Heat exchangers have been provided with soot blowers, used periodically during normal operation, in order to prevent soot accumulation. Rotating soot blowers, operated by hand, were successfully used at the Lima and Beznau (Switzerland) Power Stations.

Dirt deposits on blower bladings gradually reducing the output of the plant have been experienced on the 13,000-kw. and the 27,000-kw. units installed in Switzerland. It appeared that small amounts of exhaust gases were drawn back into the unit and the acid produced in the intercoolers by the condensing water attacked the coolers. Corrosion products were deposited on the blades of the following compressors. After exhaustive tests, it was possible to overcome this annoying difficulty. No deposits were observed during the last winter season.

Conclusions

Summing up, it can be said that all the problems encountered in the early stages, as far as they concern design or construction have been fully solved, and the solutions adopted have proved their reliability in many thousand hours of running operation and in a great number of plants operating under various conditions.

From the discussions of the various problems the following conclusions can be made:

(1) Gas turbines fired with diesel oil do not present any special problems. If fired with Bunker C oil they can be operated successfully, but short periodical shutdowns might be necessary for

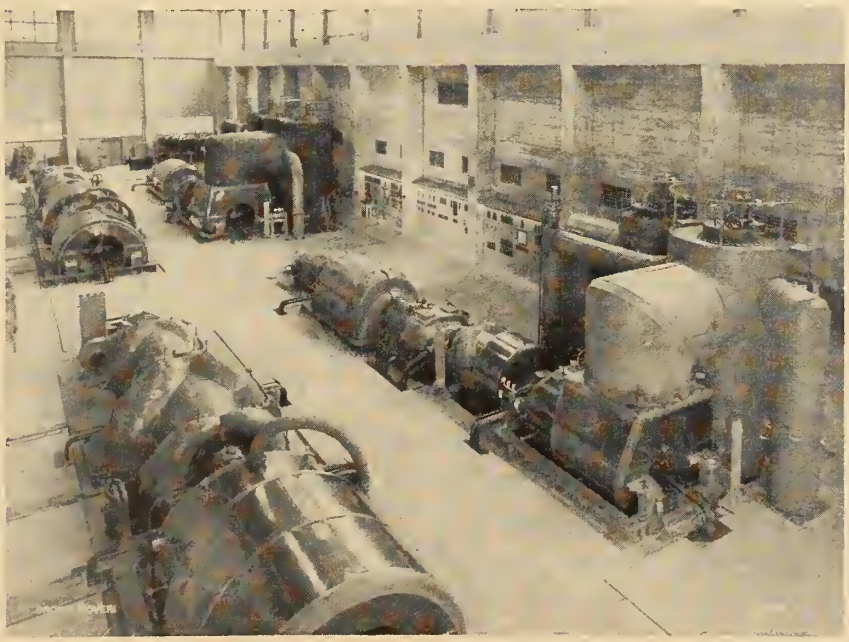


Fig. 11. The world's largest gas turbine station 1-13,000 kw. and 1-27,000 kw. (background) unit at Beznau Power Plant, Switzerland.

cleaning, according to the characteristics of the fuel used and the service of the particular plant. The amount and composition of the ashes determine the length of the operating time between washings. To assure easy cleaning the ash deposits should be water-soluble.

(2) No cleaning problem arises when natural, refinery or blast furnace gases are burned. The favourable experience gained with gas-fired Velox boilers over more than 100,000 service hours proves that units using gas fuel are as dependable as a steam plant. They will not require more shut-downs for checking purposes.

(3) Today our gas turbines are being built for about 1,112 deg. F., with 1,200 deg. F. as maximum continuous temperature. Research work is done to increase these temperatures further.

In conclusion, some appropriate applications of gas turbines should be outlined:

(a) In the utility field the gas turbine is used essentially as a peak load plant. It may be installed in hydro-electric systems for compensating seasonable power shortages. In industrial centres served by thermo-electric power it can be used as a cheap standby plant for peak-load and emergency purposes. The short starting time already mentioned, and the fact that this unit has not to be specially protected against corrosion during standby periods, add favourable features to this application.

(b) The gas turbine may be recommended as a base load unit in areas with cheap natural gas. If cooling water is scarce it becomes the ideal prime mover.

(c) Due to its favourable speeds, the gas turbine is an excellent prime mover for driving large pumps and blowers, pumping stations for natural gas pipe lines, blowers for refineries using refinery gas, or converter and blast furnace blowers burning blast furnace gas.

(d) Gas turbine locomotives are one of the most promising applications of this prime mover. The facts that they use practically no cooling water, and that their maintenance costs are low, will further this application considerably. √

Gilbert Describes NRX Reactor

In the current issue of "Nucleonics", Mr. F. W. Gilbert, who is assistant manager in charge of operations at National Research Council's Atomic Energy Project, Chalk River, Ont., gives some useful information about the facilities provided by the Canadian NRX pile for the production of radioactive isotopes and for the neutron bombardment of special materials for experimental work. The information given should help experimenters to understand better, not only the exceptional capabilities of the NRX pile, but also why it is not always possible, or desirable, to irradiate substances with the highest neutron flux available.

The capabilities of the NRX pile are well exemplified by its production of the radioactive cobalt required for the "Cobalt Bomb"—the latest and most powerful therapy unit for cancer treatment, the first of which was installed last year at Saskatoon, and the second at the Victoria Hospital, London, Ontario. The NRX pile is the only one in the world known to have been capable of producing sufficiently powerful radioactive cobalt.

In producing most radioactive isotopes, the greater the neutron flux with which a given quantity of the parent substance is bombarded, the greater is the strength of the radioactivity produce, or the shorter is the time required to produce a given strength. In the NRX pile, the neutron flux is high because the volume of its reacting core is small relative to its power. It is in this concentrated reacting core that the neutron flux is highest.

The smallness of the core, in itself, imposes some limitation on the use that can be made of the pile for isotope production and bombardment with high fluxes, because most of the space is taken up with materials necessary for operating the pile, but further than this, the highest flux exists only in a small space near the centre of the core. Since this small space has the highest neutron flux available anywhere in the world, it is in very great demand.

For high flux bombardments, the smallness of the space available is not the only limitation. Neutrons are used up in the process of making radioactive isotopes and, if too many are removed in this way, the pile will stop operating, because it depends on the neutrons to keep the chain reaction going. Unfortunately, it is permissible to remove far fewer neutrons from the centre of the pile, where the neutron flux is highest, than from other parts. However, the production of some isotopes requires a low neutron flux and many can be done equally well in slightly lower neutron fluxes available near the outside of the pile.

The Canadian pile was designed and constructed to be an instrument of research and like all instruments, it has specific capabilities and specific limitations. Within these limitations, its radiation facilities are offered to approved projects not only throughout Canada, but to other countries as well. Their use is subject only to the restrictions imposed by practicability, cost and the security of the plant.

A catalogue giving all details on radioactive isotopes available and conditions for special irradiations can be obtained from Eldorado Mining and Refining (1944) Limited, Ottawa, who handle sales of isotopes on behalf of the National Research Council's Atomic Energy project.

For details of the...

Annual General and Professional Meeting of the E.I.C., May 7, 8 and 9, 1952, at Vancouver, B.C.,

See pages 206, 212, 213 and 214 of this issue

PULP and PAPER in CANADA

by

G. M. Hobart,

President,
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A paper presented to the Montreal Branch of the Engineering Institute of Canada, December 6, 1951.

This paper outlines the economic status of Canada's major industry, pulp and paper, both present and predicted. It should give those not directly concerned in the industry a better idea of its importance in our commercial life.

Whatever distinction the pulp and paper industry has, it owes to the skill of its chemical, mechanical, electrical, civil and forestry engineers; there is no other industry in Canada which makes a more complete day-to-day and hour-to-hour use of the many skills embraced in the engineering profession. With pulp and paper, engineering knowledge and wisdom are continuous essentials in the forest shanties, on the rivers, in the mills, through the varied manufacturing processes and finally even in packing and shipment.

Engineers Essential

The benefits arising from the work of engineers are shown by technical improvements in the mills. The annual capacity of the newsprint industry alone has been increased by 15 per cent in six years. In the past five years the output per man-hour and the yield of pulp per cord of wood have both been substantially increased. New products and by-products have been developed and are on the market and a greater use has been made of waste by-products. Trees which were formerly regarded as worthless are now used for pulp manufacture. Improved cutting methods have been devised; and the industry has employed scientific talent to improve living conditions in the woods and to devise economical methods of transportation necessitated by retreating forests.

Instead of dealing with pulp and paper in a technical way, it will be more worthwhile and more interesting to draw a broad picture of the industry and of the economic and national effects flowing from the conversion of trees into pulp and paper and from its distribution to the markets of the world.

Knowledge Sparse

Many people know little about the pulp and paper industry for much of it is hidden in the hinterlands, and, despite its size, it consists of only 130 mills, located across the country in every province except Prince Edward Island, Saskatchewan and Alberta. These mills vary greatly in size. Some are little coffee pots grinding out only five or six tons of pulp a day; at the other end of the scale there are three mills with a daily capacity of 1,000 tons of paper each.

The mills making cardboard from waste paper are generally located in or near cities where a supply of raw material is available. These mills contribute less than 10 per cent to the total Canadian pulp and paper production, though their daily output is worth a quarter of a million dollars.

The nine million tons of pulp and paper produced in Canada every year is worth something over a billion dollars and far exceeds in value the country's entire grain crop or its entire mineral production of every kind. Pulp and paper accounts for one out of every ten freight cars loaded in Canada, for 25 per cent of our exports and bring in 35 per cent of our United States dollars. The industry is the largest power consumer, using about one-third of the

total kilowatt hours employed in industry. The pulp and paper industry stands first in dollar production, first in employment, first in wages paid and first in exports.

Products Varied

More than a thousand varieties of pulp, paper and paperboard are made in Canada. Paperboard and fine papers account for about 17 per cent of the total tonnage, woodpulp, chiefly for sale abroad, for 25 per cent, and newsprint, for about 58 per cent. Before 1939 newsprint constituted 66 per cent of the total output, but since then ten new mills have entered production and none of them produces newsprint, because newsprint is generally the least profitable product of the paper industry and other varieties offer a more attractive incentive to idle dollars.

Some disturbance has been created by headlines in the press that would make it appear that the pulp and paper industry is irresponsible and lacking in ethics, a situation which would be repugnant to decent people such as, say, engineers. The industry has been accused by some of holding production back in order to force prices up, and by others of holding prices down so as to discourage the building of more mills. Newsprint production and prices are not fixed by the desires of the publisher nor by the views of the manufacturer.

Engineers Salvage Industry

In the 20's newsprint was to promoters what Western oil is in the 50's. Five years before the crash of 1929 the newsprint industry was feeling the effects of overproduction.

After the industry had gone through the wringer and was of no further interest to the promoters, the engineers took over at reduced pay and worked to salvage the wreck. It was a period of sweat, tears and austerity. Those were the days when paper stocks could be bought for 50 cents a share, bonds dropped to one-tenth of the value of the assets back of them and not even the bond interest was being earned. The price of newsprint had dropped to 2 cents a pound, f.o.b. New York. At this stage the newsprint industry was truly a living example, though almost dead, of the folly of overbuilding, overproduction and oversupply.

At the end of World War II, the demand for newsprint rose to unprecedented heights because of increasing economic activity and of the growth of population and of literacy, not only in North America, but all over the world. This strong demand drove the world price above $200 per ton, many United States publishers paid more than that for European paper.

Paper Prices

One might say why has the Canadian price not risen higher than $116 per ton. As each newsprint company sets its own price for its own production the writer can only offer his own personal opinion, which is that the men now in control are those who were tempered by 15 years of adversity, they instinctively avoid creating a false prosperity like that of halcyon days of the 20's which preceded the financial collapse of the 30's. As a result, the Canadian newsprint price has lagged behind the general United States wholesale price. To be level with it, the price of newsprint in New York should be $125 per ton.

Canadian newsprint prices are the lowest in the world by a wide margin. In fact, newsprint is being sold at a figure below that of the average value of its two components, groundwood and chemical pulp. For instance, in one mill 100 tons of chemical pulp yields the same profit as 167 tons of newsprint.

Since 1946 the newsprint industry has been operating at capacity and is putting some fat on its bones for the first time in two decades. The industry has used this prosperity wisely.

It has caught up on deferred maintenance and has ploughed back more than half its earnings into improvements, betterments and additions. It has greatly reduced its funded debt and is at long last paying its shareholders a return on their investment, but that return up to now for an original shareholder in most companies is less than the the return would have been had he invested in Government bonds. So much for the financial aspects of the business. It has progressed in protecting and perpetuating its forest resources. It has embarked on a comprehensive research program. The earnings of its workers both in the mills and in the forests are amongst the highest in Canada.

Production Forecast

Turning to supply, United States publishers are alarmed about the future supply of newsprint, which is their principal raw material.

The American Newspaper Publishers Association has issued a statistical analysis which shows an apparent need of newsprint production in North America of 8,700,000 tons by 1960, compared to a production of 6,300,000 tons in *1950*. Based upon this report, there have been pressures coming from many directions for an increased production of newsprint.

This increase will amount to 2,100,000 tons between *1951* and 1960, which is an acceleration of 230,000 tons a year over the next nine years. The Canadian newsprint industry can show an actual annual increase in production since 1946 of 177,000 tons or over a million tons in six years. It is this increased production of newsprint in Canada that has made possible the post-war newspaper expansion in the United States.

Probably the same rate of increase can be maintained in the next nine years if United States consumption will warrant it, partly by continuing the speed-up program and partly by new construction. One estimate shows that increased capacity from plant improvement will amount to 125,000 tons in 1952 and to 175,000 tons in 1953. Preliminary figures for 1954 show over 100,000 tons of increased capacity already projected for that year. The balance of the increase needed will have to be supplied by new paper machines or by new mills. Some projects are already under way, such as those at Elk Falls and at Red Rock, and more are being planned such as those at Kitimat and at Nelson. The potential for more production exists in Canada and it is safe to assume that Canada can, and will, continue to respond to rising demand.

Current Shortages

It is a fact that a newsprint shortage does exist at present in many countries outside North America. However, the European countries which are now making appeals for more newsprint to help in fighting Communism were never traditional Canadian customers. Moreover, European mills exported more than half a million tons of newsprint this year at two to three times the Canadian price. It is probable that if Canadian mills sold their newsprint at the world price instead of the New York price, European demand for North American newsprint would be less persistent.

Nevertheless, the United States and Canadian Governments recognize the responsibility which is involved in Canada's producing and the United States consuming 60 per

cent of the world's newsprint supply, as newsprint is the medium for the mass distribution of ideas and is therefore an essential weapon in the battle for men's minds.

This characteristic removes newsprint from the category of purely commercial products, so that political considerations sometimes supersede commercial contracts in effecting its distribution. As Mr. R. M. Fowler said in Boston recently. "If Western nations are to build a democratic front against Communism, our effort cannot be restricted to material things, but must also embrace the mind and the spirit, and that means an informed public opinion and that means newsprint." For purely political reasons 3,000 tons of Canadian and United States newsprint on order for domestic publishers have been diverted to France and 25,000 tons more to other Western European countries.

The major part of this paper thus far has been devoted to newsprint because of its importance, not only in Canadian, but also in international affairs, but it constitutes only 58 per cent of the production of the Canadian pulp and paper industry.

Like the newsprint industry which exports 93 per cent of its output, the pulp mills also send nine-tenths of their production abroad. There it is used in the manufacture of paper and paperboard and also by the chemical industry, which is steadily increasing its consumption.

Additional Products

The rest of the industry's tonnage falls into two chief categories (1) paperboard, and (2) all other papers, including book, fine, wrapping, and hundreds of other grades. One might deal at some length with paperboard, that handmaiden of commerce which in sombre shipping containers moves the goods and in more brightly adorned boxes sells them. One might touch on the manufacture of hardboard, wallboard, and all the building papers. One might offer the reader an erudite discussion of the fine paper industry with its writing, bond, ledger, and other grades, not to mention paper made from straw, and also paper made from rags, still the finest paper made. But in this hop-skip-and-a-jump over the industry as a whole, the writer must confine himself to pointing out that in one important respect the mills producing these papers differ from newsprint and the pulp mills, namely, their output goes chiefly to the domestic market. Over the years, about 85 per cent of Canada's production of fine papers and paperboard has been used at home. The remainder is sold abroad, chiefly in markets where it can compete under existing tariffs, which unfortunately does not include the United States.

Canada's pulp and paper production, equivalent to about three and a half million dollars of new wealth daily flows from the forests. Perhaps the best introduction to the woodlands situation is contained in the words of the poet (?) Ogden Nash. He has this to say regarding the pulp and paper industry, the publishers, and the forests:

"I think that I shall never see
A billboard lovely as a tree.
I think that I shall never see
Aught lovely as a pulpwood tree.
A tree that grows thro sunny noons
To furnish sporting page cartoons.
A tree whose girth will prove its age
Is ample for a want-ad page.
A tree, with grace toward heaven rising,
Men macerate for advertising.
A tree that lifts its arms and laughs
To be made into paragraphs.
A tree that falls before the saw
A five-star "Extra" in the raw.
Perhaps unless the billboards fall,
I'll never see a tree at all."

This ditty reflects the "Woodman-spare-that-tree" attitude prevalent among those ignorant of the facts of the forest and of its characteristics and economics.

Some Economic Facts

As for economic facts, it is first well to recall that woodlands account for about one-third of all the primary production of Canada; and that on this primary production is based the entire edifice of Canadian commerce—the banks, the insurance companies, the utilities, retail trade and most of the capital and consumer goods industries. In short, both the forests and all the forest industries are the very foundation of Canadian economy.

As for the facts regarding the forests, these are not as bad as they are sometimes pictured. From studies to date, it appears to government foresters that the volume of growth in Canada's forests exceeds the annual consumption, which includes the depredations of fire, insects, and disease, those ravagers of the woodlands which consume more wood each year than all pulp and paper mills combined. The paper industry consumes only 19.4 per cent of the annual depletion, in comparison, 21 per cent is cut for firewood.

It is also to be remembered that trees are a crop that should be cut when mature. The most socially useful way of maintaining forests lies not in discouraging the man with the axe, but rather in encouraging operating and management methods which will provide crops in perpetuity and which, at the same time, will make the forest areas increasingly productive in the years to come.

Current Harvests

Turning from the forest in general to pulp and paper woodlands in particular, the wood harvested by the pulp and paper mills in Canada in the 1950-51 season was at the highest level on record. But the cut represented only an eighth of a cord per acre over the 140,000 square miles of forest under lease to the industry. All scientific measurements to date indicate clearly that the average annual regrowth far exceeds this figure. In short, these woodlands as a whole have not been overcut, nor is the present cut impairing their total wood resources. They can deliver their present harvest in perpetuity, provided fire and insect losses do not become too great.

Technical Advancements

Throughout the industry technical progress in forest management is being made. One mill is changing over to the use of hardwoods in the manufacture of dissolving pulp, the most costly pulp made, and in doing so is making a more efficient use of the forests in its immediate area. This mill has also set up a tree farm with an initial area of 3,000 acres and is encouraging farmers in the region to manage their woodlots on a perpetual yield basis. Another company in northern Ontario has purchased extensive freehold limits which it is operating not only on a perpetual yield basis, but also on a basis of reconverting these holdings to the growth of the more valuable species. Still another mill is using more than 20 species, including bark and branches, in the pulping process. Several companies operate test forests, and all are engaged in silvicultural studies of one kind or another. Progress in silviculture is on the way even though the foresters do not as yet know all the answers.

Regrowth

What is not generally understood is that normally the forests reproduce themselves. There are vast limits which were cut 30 years ago where the regrowth is first class and where the new growth being added each year exceeds that which obtained in the same forest prior to first cutting. Indeed, in most pulp-

wood operations good regeneration is the rule and poor regeneration the exception. After all, last spring nature unaided laid down a billion new seedlings in the limits of the pulp and paper mills. And the aim of any sensible woods manager is to cut in a fashion which will encourage regrowth. After all, he is paid to maintain, not to wreck, the source of his company's raw material.

Government Encouragement

The Quebec Government has promoted forest conservation for more than a quarter of a century. In 1907 a forest service was inaugurated, designed to protect the forests and at the same time to encourage intelligent utilization of forest resources. In 1921 Quebec regulations required limit holders to make an inventory of standing timber and to prepare a working plan of their cutting operations. The purpose is to determine the growth possibilities of each licence and to limit the cut each year to the amount added by growth each year, thereby insuring sustained yield, Quebec was 20 years ahead of any other province in passing such regulations.

The Province has an active program in the field of forest education, including the Forest School for professional foresters, opened in 1912, the Provincial Ranger School opened in 1923, and others, such as the Forest Extension Service, instituted in 1942, to teach farmers to practice sound forest management in their woodlots. A large proportion of Quebec's raw wood supply comes from small private woodlots and the benefits of this forest extension policy will be marked as the years go by, just as the policies introduced in the early 20's are bearing fruit today.

Industry Has Policy

The Canadian pulp and paper industry has a declared forest policy of its own, based on practical experience, for better methods of using the forests for the profit of the industry and of the people of Canada. With mills worth a billion dollars depending upon the forests for their raw material, you may depend upon it that the pulp and paper industry is the forests' greatest conservator.

Pulp and paper is a great national industry, Canada's dominant industry. That it may best serve the needs of Canada requires a wide understanding of its operations and problems, particularly by those who, like the engineer, hold in their hands our national destiny. √

Cathodic Protection of Water Tanks

How Protection Obtained

Corrosion of a metal in contact with an electrolyte is known as galvanic corrosion. Anodic and cathodic areas develop on the surface of the metal, due to local chemical or physical differences in or on the metal. Electric currents pass from the anodic areas to the cathodic areas. As a result, metal ions go into solution at a point where the current passes into the electrolyte. The reaction products formed increase the resistance to the current flow, and the current shifts to a new location. This continues, and gradually the complete structure becomes corroded.

Complete cathodic protection is obtained by applying to the steel surface to be protected a slightly greater voltage than that of the galvanic current set up by the local cells. Thus, the potential of the impressed current overcomes the potential of the local cells, and the impressed current prevents the flow of current from the metal anodes to the cathodes.

Storage tanks are protected by placing graphite ground anodes in a predetermined arrangement within the tank, usually suspended from the tank roof. The anodes are connected to the positive side of a rectifier or any other suitable source of D.C. current, and the shell to the negative side. The flow of current is then regulated to provide the required current density on the shell of the tank. Carbon and graphite enjoy distinct advantages over metals as anode materials, since the products of the electrolytic action at the anode are gases. Metals, on the other hand, go in solution and may cause contamination, as well as increasing the resistance of the electrolyte.

Principal Consideration

The main consideration in the design of a cathodic protection system for a water tank are the chemical analysis and the ohm resistivity of the water. The analysis of the water should include the number and type of dissolved solids. From this information, the corrosiveness of the water can be determined, and in turn, the current density, required to prevent corrosion by this particular solution, can be calculated.

Waters vary greatly in their corrosiveness; thus, the current density required to protect the steel will vary according to the water supply. Current densities generally run between one and five m.a. per square foot in fresh water tanks. The shape and size of the tank determines the wetted steel area. This, coupled with the characteristics of the type of protective coating, determines the total current required. These factors also affect the voltage at which the system will operate, but the primary voltage factors are the choice of electrode material and the resistance of the water.

Voltage Control

The required voltage at which a cathodic protection unit operates successfully may be controlled by either the polarization effect at the anode or at the cathode, or by the resistance of the solution and the inter-connecting metal path. In the case of most water storage tanks there is little polarization at either the anode or the cathode. Since the resistance of the metallic lead is negligible compared to the resistance of the water, the latter may be said to control the amount of corrosion at local anodes. Thus, the ohm resistivity of the water determines the operating voltage for the system of cathodic protection. Most graphite anode systems used to protect fresh water storage tanks operate between 6 and 36 volts.

The configuration and number of electrodes used in the cathodic protection system also affect the voltage at which the system will operate. It is possible to protect a fairly large storage tank by means of a single anode located at the centre of the storage tank. However, due to the design of the tank, it may be necessary to use more than one anode to overcome the effects of shielding and other complicating factors. In such cases the anodes are usually placed in a ring. Also, in some water tanks an anode is placed in the centre of the riser pipe to provide protection for this part of the system. Such anodes are usually connected as a separate system from those inside the tank. They usually require a smaller voltage, because the distance from the anode to the protected area is not as great in the riser pipe as it is in the main body of the tank.

POWER SUPPLY CO-ORDINATION in QUEBEC'S EASTERN TOWNSHIPS

by

Dan Anderson, M.E.I.C.,

Plant Manager,
Southern Canada Power Company,
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A paper presented before the Montreal Branch of The Engineering Institute of Canada, April 12, 1951.

In this paper the author tells how hydraulic studies and effective co-operation between government, power producers and industries brought about a substantial increase in energy output, without capital expenditure or additional operating costs.

The Eastern Townships of Quebec is one of the rapidly expanding industrial areas of the province and adequate power supply is of prime importance for future growth. In it are located many large textile mills, rubber plants, paper mills, tobacco factories, machine shops and a variety of specialty plants. The industries at the beginning were served by small individual water power plants and steam engines but as they grew and expanded the need for a central supply became more necessary and small central generating stations were built in the towns, some of which are still in operation.

This paper deals largely with the "Eastern Townships" district served by the Southern Canada Power Company Limited. The area served is bounded roughly by the Richelieu River on the west, the St. Francis River on the east, the International border on the south and as far north as St. Guillaume. West of the Richelieu River the district is served by Gatineau Power Co. Ltd., Shawinigan Water & Power Co., and the Quebec Hydro Electric Power Commission. Along the St. Lawrence and east of the St. Francis the Eastern Townships is served by Shawinigan. In addition there are several municipal plants, namely, Sherbrooke, Magog and Coaticook. The Dominion Textile Company operates its own plant at Magog and Penmans Limited at Coaticook and St. Hyacinthe.

The terrain of the Eastern Townships is flat in north and western parts and rises gradually in the south and east, where elevations of 3000 feet are found in the vicinity of Lake Memphremagog. The principal watersheds are the Richelieu, rising in Lake Champlain; the Yamaska, with its several branches rising in the vicinity of Brome Lake; and the St. Francis, which rises in Lake St. Francis and flows in a south westerly direction as far as Sherbrooke and thence north westerly, to empty into the St. Lawrence at Pierreville, Sorel. At Sherbrooke it is joined by the Magog River which drains Lake Memphremagog.

From its source to its mouth the St. Francis River drops over 900 feet. East of the St. Francis the Townships are drained by the Nicolet and Chaudiere Rivers. Of the rivers mentioned, only the St. Francis has sizeable developments. On the Richelieu the drop between Lake Champlain and Sorel is only 90 feet and only one development has been built, at Chambly. The flow of the Yamaska River is small at low water and hydro developments are small. The development on the St. Francis is now over 100,000 h.p. and is the largest block of power developed in the area.

The industrial growth of the district can be said to have commenced during the first great war and the organizing of the Southern Canada Power Company took place shortly before that time. See Fig. 1. Power developments on the St. Francis River are shown in Table I.

Storage Reservoirs

The Quebec Streams Commission, working with the power users on the rivers, for many years have endeavoured to improve stream flow conditions. Two storage dams were built at the end of the first great war at the outlets of Lake St. Francis and Lake Aylmer to store the excess run-off spring and fall, and to control the flow. These dams, namely Allard and St. Gerard, regulate the flow at its source. At Magog the power dam of the Dominion Textile Company exercises a limited control for storage purposes on Lake Memphremagog of 3.72 feet, which is fixed by the International Joint Commission on boundary water levels. See map of St. Francis watershed and tabulation of reservoirs—Fig. 2. Table II lists the storage dams now in use, and their capacities.

An interesting comparison of the position of the St. Francis River in respect to stored water as compared to storages on other rivers in Quebec is shown in Table III.

It will be seen that, by comparison, the St. Francis River has much lower regulated flow than the other rivers. This is partly due to lack of reservoir capacity and also the settled nature of the watershed, where most of the good farming land has been cleared. The other watersheds mentioned are covered largely by bushland which is not very suitable for agriculture. To gain further improvement on the St. Francis additional storages must be de-

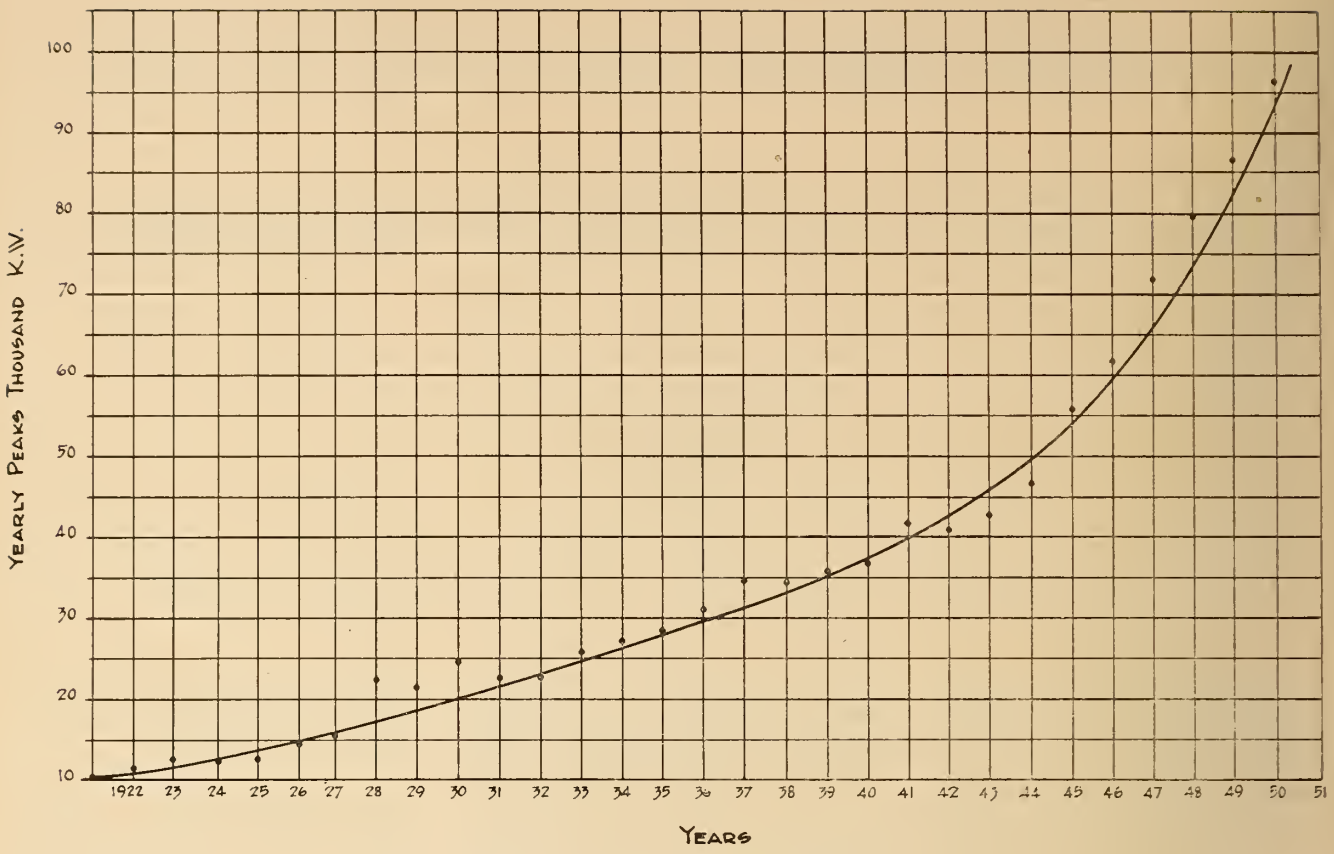

Fig. 1. Graph of load growth of The Southern Canada Power Co. Ltd.

List Of Power Developments

River and Power Sites	No	Feet Above Mean Sea Level: Head Race	Tail Race	Head Ft.	Drainage Area Sq. Mi.	C.F.S. Full Load	Installed H. P.	Owner
St. Francis								
Drummondville	1	264.	232.	30	3,730	7,000	18,400	Southern Canada Power
Hemmings Falls	2	319.	269.	50	3,720	7,000	33,600	Southern Canada Power
Windsor Mills	3	410.	394.	16	3,210	3,200	4,700	Canada Paper Co.
Brompton Ville	4	456.	424.	32.5	3,080	3,085	9,140	City of Sherbrooke
Lower East Angus	12	580.	562.	18	1,530	560	728	Brompton P&P Co.
Upper East Angus	13	617.	582.	35	1,280	1,700	5,100	Brompton P&P Co.
Westbury	14	650.	623.	28	1,265	1,950	5,800	City of Sherbrooke
Weedon	15	792.	762.	30	1,120	1,850	5,550	City of Sherbrooke
Disraeli	16	905.	865.	40	490	1,100	2,500	S.W. & P. Co.
Magog								
Sherbrooke	5	520	465	55	765	900	3,500	Southern Canada Power
Frontenac	6	565	522	43	764	750	2,700	City of Sherbrooke
Sherbrooke	7	586	566	20	763	1,100	2,000	Paton Manufacturing Co.
Drummond	8	598	586	12	760	700	750	City of Sherbrooke
Rock Forest	9	636	605	31	740	980	3,000	City of Sherbrooke
Magog	10	657	636	21	685	840	1,600	Town of Magog
Magog	11	682	657	25	680	1,320	3,000	Dominion Textile Co.
Coaticook								
Waterville	17			32	207	140	400	City of Sherbrooke
Perkins	18			27			300	Perman Manufacturing Co.
Coaticook	19			136	137	160	2,000	Town of Coaticook
Dixville	20			26	95	100	240	Southern Canada Power
Burroughs Falls Niger River	21			175			2,000	Southern Canada Power
						Total	107,008	H.P.

Table I

Fig. 2.

veloped, and better co-ordination of the use of existing storages should be brought about. Additional storage sites exist such as Brompton Lakes, several small lakes at the upper end of the river such as MaGill Lake and Watapeka Lake on the Watapeka River. These possible sites have been studied in the past and up-to-date estimates of cost would be helpful. Fig. 3.

Reservoir Operations

Last year a committee was set up by the Sherbrooke Chamber of Commerce to seek ways and means of improving stream flow. The Committee had representatives from The Shawinigan Water & Power Company, Brompton Pulp & Paper Company, The City of Sherbrooke, Canada Paper Co. Limited, the Southern Canada Power Company, and the Quebec Streams Commission. A careful review of the present method of reservoir operation was first undertaken. The present scheme provides 660 c.f.s. flow at the outlet of Lake St. Francis or better, depending on water available. At first sight this arrangement would seem satisfactory, since the watershed at this point is only 464 square miles and the mean discharge is about 800 c.f.s. It does not take into account, however, sudden flash floods, rain storms, or the normal spring and fall floods.

Several studies were made to determine the effect of reducing flow from the reservoirs at times of high water, and discharging the water later at low flow periods. It was found if the lower plant at Drummondville became the basis of a fixed policy in regard to minimum flow, then at times there would be little or no stream flow available at the plants just below the reservoir. As they were not fully interconnected electrically the scheme would be unsatisfactory. Furthermore some of the paper mill generating plants were largely equipped with turbine driven pulp grinders and, therefore, could not conveniently exchange electric power.

The next scheme considered was to work out a plan based on the centre of generation which was found to be near Windsor Mills. This scheme to be made fully effective would require a permanent staff of hydraulic operators gathering data from day to day, plotting results, and scheduling the operation of each plant including the control of all reservoirs. It would also involve a complicated accounting of power interchange through the electrical connections of the Shawinigan Water & Power transmission system. An alternative to this would be an electrical interconnection system of tie banks with the power users with the Southern Canada Power System, including interchange agreements.

These studies led the Committee to seek a more convenient and simple method of improved operation that could be followed out by the Quebec Streams Commission. For the past 23 years the records of the Quebec Stream Commission show that the mean flow at the outlet of St. Gerard Dam has been 1180 c.f.s. or 1.8 c.f.s. per square mile. The maximum was 1730 c.f.s. and the minimum of 780 c.f.s. or 1.18 c.f.s. per square mile. For 90 per cent of the time it is 840 c.f.s. or 1.27 c.f.s. per sq. mi. At a point just above the Weedon Plant of the City of Sherbrooke the Salmon River discharges into the St. Francis, which gives a total watershed area of 1120 sq. mi. of which 660 is controlled by the two storage dams at Allard and St. Gerard.

From these figures it was decided to try and work out a scheme that would take advantage of the natural run-off of the Salmon River, as well as the controlled flow of the St. Francis at this point. See Fig. 4. A preliminary figure of 1200 c.f.s. at Weedon was tried, and based on the past stream flow records, would be possible in every year during the past 10 years, except the year of very low flow year of 1947-48. The net result of this scheme was an estimated improvement in power generation on the part of plants on the St. Francis of about 5,000,000 kwh. per year on the average for the past 10 years.

This figure is based on average heads of the plants on the river,

Table II

Storage Reservoirs St. Francis River

NAME OF DAM	OWNER	CAPACITY SQ. MI. FT.	DRAINAGE AREA AT DAM SQ. MI.	LAKE AREA SQ. MI.	MAX W.L.	DRAWDOWN
Allard on Lake St. Francis	Quebec Streams Commission	438	464	19.7	952.4	27
St. Gerard on Lake Aylmer	" " "	130	660	14.2	815.7	10
Weedon on Weedon Lake	City of Sherbrooke	3.6	1130	-	800	2
Norton Pond, L. Averill Lake B. Averill Lake	Coaticook River Power Co.	24.7	30	3.45	-	21.5
Lake Massewippi	Southern Canada Power Co. Ltd.	36.5	239	7.3	528.4	5
Lovering Lake	" " " "	11.3	18	1.92	795.7	6
Magog	Dom. Textile Co.	148.8	680	40.0	682.57	3.72
Rock Forest on Lake Magog	City of Sherbrooke	14.9	740	3.7	636	4
Webster Lake	Southern Canada Power Co.	5.1	6.5	1.2	-	4

Table III

Tabular Comparison Storage Reservoirs On Large Rivers In Quebec.

NAME OF RIVER	DRAINAGE AREA SQ. MILES	MEAN FLOW C.F.S.	REGULATED FLOW CFS.	RESERVOIR CAPACITY SQ.MI.FT.	RESERVOIR CAP. PER SQ.MI.of D.A.	RUN-OFF C.F.S. PER SQ. MI.
St. Maurice (La Gabelle)	16,550	25,600	19,500	11,900	0.72	1.6
Gatineau (Mouth)	9,600	12,800	10,000	5,000	0.52	1.35
Lievre (Mouth)	3,615	5,870	4,100	1,462	0.41	1.59
St. Francis (Drummondville)	3,730	6,600	2,200	812.9	0.22	1.73

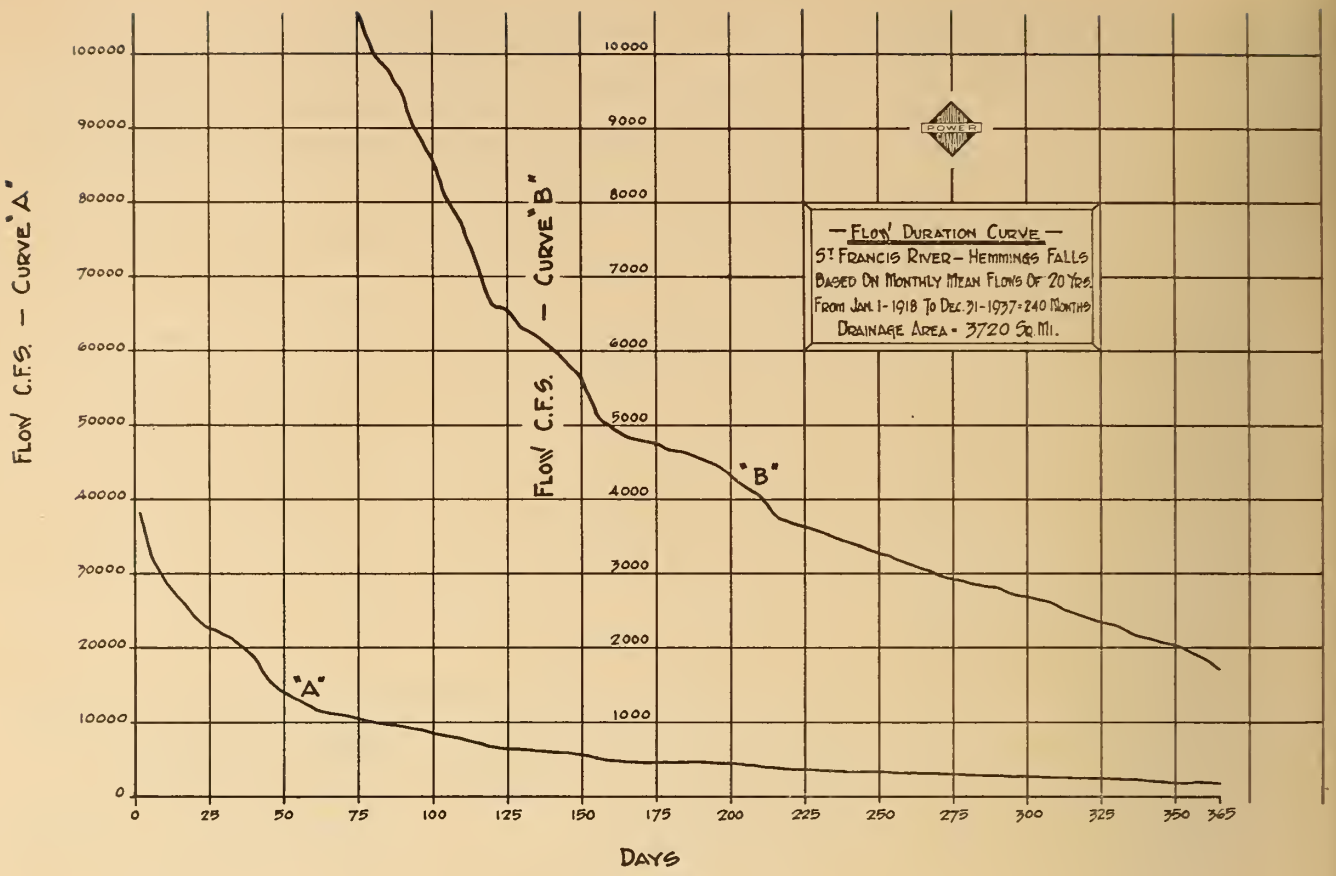

Fig. 3.

and does not take into account flash floods due to rain storms or the installation of flash-boards at many plants that give extra heads at times of low water. This satisfactory result has been obtained without additional operating cost. It is also possible that the controlled flow at this point, with experience, might be increased to possibly 1,400 c.f.s. with added increase in power generation, especially at the low water periods when it would be of considerable value.

The tabulation (Table III) of rivers in the province where large power developments exist shows that further power generation can only be had with improved regulation of the river. Lake Memphremagog water level is fixed by international agreement as 682.57 feet (Geodetic Datum) maximum and 678.85 minimum or a drawdown of 3.72 feet. This drawdown is equivalent to 148.8 sq. mi. feet of storage. Using the experience previously explained in connection with the St. Francis and Aylmer dams, and holding back as far as possible the stored water at periods of high run-off on the St. Francis and discharging it at low water, the power generation at low water periods can be greatly improved.

Until recently, the control of Lake Massawippi was exercised by a saw mill at the outlet of the Lake, and by the Quebec Central Railway which has a half interest in the mill dam. Further development can be obtained by dredging the channel leading from the lake to the dam and adequate sluicing capacity at the dam. This improvement would give 35 sq. mi. feet of storage on the lake, which would be available at low water periods.

Among the smaller lakes on the watershed some storage has already been developed. On the Coaticook River in State of Vermont a chain of lakes, namely, Little Averill Lake, Big Averill Lake and Norton Pond have been operated as storages for many years by the Coaticook River Power Company. This Company is jointly owned by the power users on that river and controls storages totaling 24.7 sq. mi. ft. Lovering Lake near Fitch Bay has a control dam which impounds 11.5 sq. mile ft. Webster Lake with its outlet on Key Brook flows into the St. Francis at Bromptonville, stores 5.1 sq. mi. feet. There are storage possibilities at the headwaters of Salmon Brook in the Brompton Lakes, and on the Watapeka River which comes in at Windsor Mills.

Electric Power Supply

The first power development of the Southern Canada Power Company was the Sherbrooke Railway and Power Co's plant on the Magog River at the confluence of the St. Francis River, which operates under a head of 55 feet. This plant supplied the Street Railway, some of the industries in Sherbrooke, Lennoxville and a 22,000 volt line was built to serve the Copper Mine at Eustice, with a branch to Waterville and thence to North Hatley and Rock Island.

The next development was at Drummondville, where a plant operating at 30 feet head was built in 1918. This was followed by the Hemmings Falls plant in 1926 where a site providing a head of 50 feet was developed. These two plants, three miles apart and using the same water, operate effectively as peak load plants due to the large head pond at Hemmings Falls. At periods of low water the stream flow is stored up at weekends and nights and used to control peak loads during the period of high demand in the daytime.

The original installation of machinery at Hemmings Falls included two generators of the six installed that provided 30 cycle power. These

machines were converted to 60 cycles about 1930. The South Shore system of the Shawinigan system is interconnected with Hemmings Falls. Two 110,000 volt lines feed into the Southern Canada system at this point. These lines cross the St. Lawrence River at Sorel and Three Rivers. Two large transformer banks step down the power from 110,000 volts to the 48,000 volt transmission system of the Southern Canada Power Company.

In addition, at this point the Shawinigan Company has step down banks of transformers that reduce the voltage to 66,000 volts. Power at this voltage is transmitted to Asbestos, Windsor Mills, Brompton-ville, Sherbrooke and East Angus. In 1940 the Southern Canada Power Company built a 110,000-volt transmission line from Hemmings Falls to St. Cesaire, where a central high voltage substation steps down the power to 48,000 volts, which is transmitted to Granby, St. Johns, Farnham and Bedford. Each of the large 20,000 kva. transformer banks has a step voltage regulator to control the supply voltage at this point.

The St. Cesaire Substation is a central point of interconnection with the Quebec Hydro Electric Power Commission by means of a 110,000 volt transmission line coming from Beauharnois to St. Cesaire by way of Chambly. This connection makes a complete connection between two great sources of supply, namely Beauharnois and the St. Maurice Valley plants.

The Southern Canada territory, as well as the other users in the Eastern Townships, are now on a high voltage bus supplied with power from some of the largest hydro electric sources in the world. The great benefits of this source of power supply are being continuously extended, and last year a 110,000 line was built from St. Cesaire to Magog. Here a large distribution substation was constructed to serve the south eastern part of the system.

The territory served by the Southern Canada Power Company has grown rapidly. Drummondville at the time of construction of the power plant had a population of 2,500; it now has over 30,000. The number of customers, small at the start of the Company, has reached 65,000. Nearly 600 miles of 48,000 volt lines are now operating. Rural lines built slowly at first have been rapidly extended since the war and a rate of a mile a day was experienced in the past four years. The total has now reached 2,600 miles.

Transformer sizes and ratings are purchased as far as possible on standard size taps and ratings. In central substations, three phase units are bought and installed with adequate provision of spare units located at strategic points so in case of breakdowns replacements can be quickly made. To take care of local requirements the Company maintains 24 branch offices, for billing, collecting, maintenance and operating purposes. √

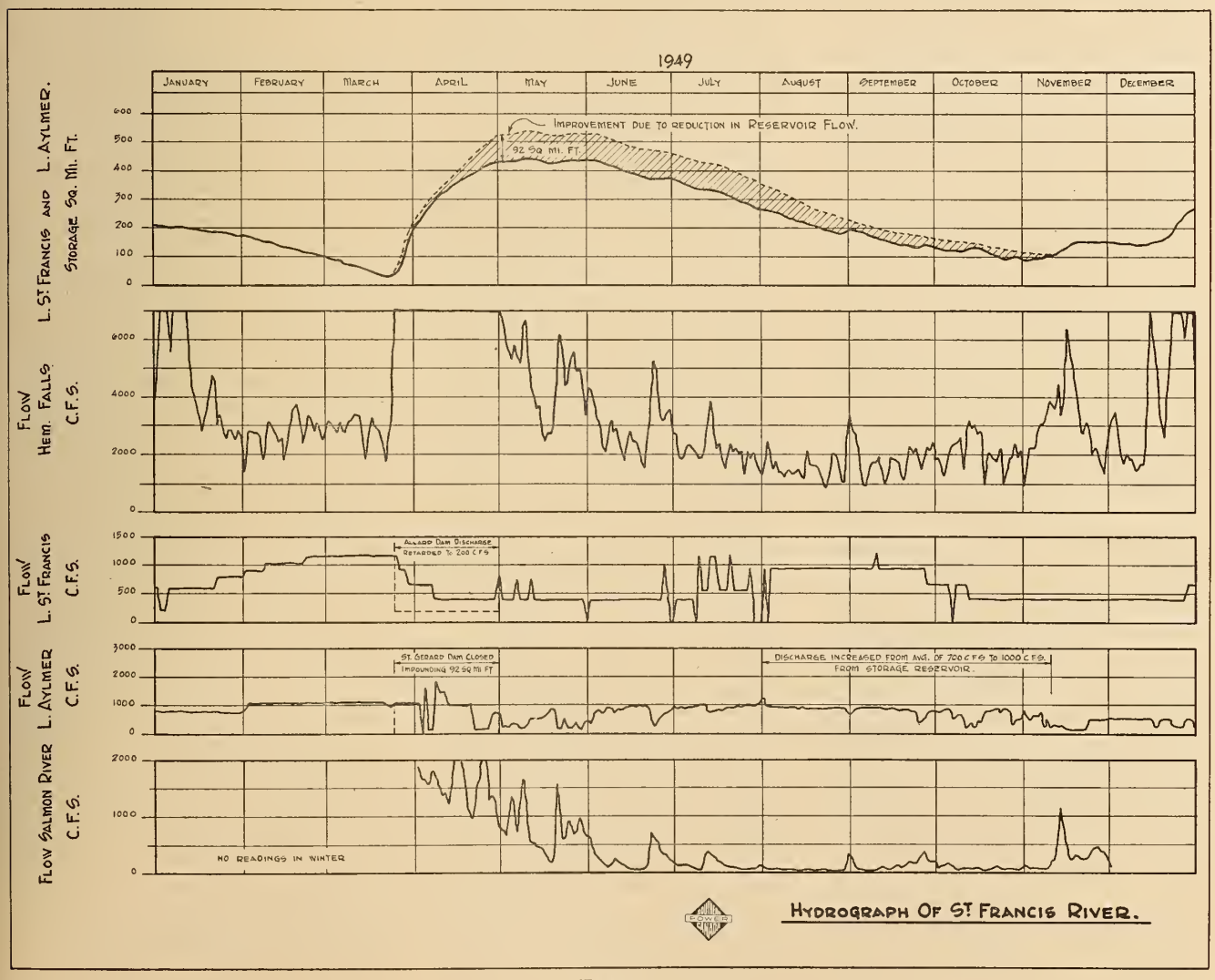

Fig. 4.

Engineering Education— A Bridge Between Ignorance & Understanding

by

F. M. Dawson,

President,
American Society for Engineering Education, 1950-51.
Dean of Engineering,
State University of Iowa.

Presidential address to the Annual Meeting of A.S.E.E., East Lansing, Michigan, June 27, 1951.

The American Society for Engineering Education has always been extremely active in furthering the interests of Engineers in their profession. It has been wise and courageous also in stressing the educational side of its twofold duty of training and at the same time educating our clientèle, the students. Primarily, we are a society of educators with a special job of developing, as best we may, embryo engineers. Young men and women come to our schools and colleges directly from high school at about the age of seventeen. We would like to do more for them than we usually are able to do as teaching is limited to 144 to 156 weeks in the average four year course. Before going any further, let me point out that 144 weeks is not a long time and that all must make the utmost use of their talents if the job is to be accomplished in such a short time. Several colleges have found it necessary to extend the time of formal training to five academic years, others to four and one-half or four years and summer sessions or camps. These operating on the co-operative plan of Engineering Education are likewise limited in time. But in any case, we as Engineering teachers had some 184,000 students of all types under our charge last year. In almost all cases, these students ranked in the upper one-half of their high school class and because of student mortality, caused by the usual consequence of adjustment to college life and to the rigorous training of an engineer, we know that less than one-half of those who began as freshmen will be graduated. All of which means that we had a selected group to start with and an even more select group at the finish of the formal courses for the various degrees.

Bridging the Gulf

In this review one prominent feature stood out above all others and it is to this that I wish to devote my remarks this morning. Many have treated engineering education as an end in itself, giving the impression that if only we were well-trained or sufficiently indoctrinated or thoroughly educated all else would follow as a matter of course. To me this is not so. I believe that education, is a method or way and not an end in itself. It is a means whereby something else may be accomplished.

Education may be likened unto a bridge spanning the gulf between ignorance and understanding. It is a way, a means of transport. It is true that in and of itself it is a material structure, but its main purpose is to be a support for a highway or a railway, in other words, a means of conveyance.

Imagine a canyon deep and wide. On one side is ignorance, dark and dismal and full of superstitions and fears. On the other side of the canyon is understanding, which includes knowledge, freedom to think and an absence of these terrible restraints on thoughts, such as the fear of ridicule, the fear of fear itself. Understanding gives a chance for the brilliant light of opportunity to show the way to better living, better mental health and freedom of religion guaranteed to all.

It is possible for a man to cross the chasm by climbing down one side, going across the treacherous rocks at the bottom and laboriously climbing up the other side. This is the way it was done of old: each had to find his own way down, across and up again. Then someone threw a rope across and we had a rope bridge on which a few only could cross at a time. These few had to be hardy souls who braved the flimsy swaying span. Later stronger and better bridges were built and they served their purpose of furnishing a way or method of progressing from ignorance to understanding. Many could now cross whereas before only individuals could go.

My main thesis, therefore, is that education is something that is a means rather than an end. In this respect it is something like money. It is valuable when properly used and dangerous when mis-used. It is necessary and desirable, not for itself, but the use to which it may be put. Money, at least present day money, is a medium of exchange enabling the possessor to transfer from one to another certain rights to things. Now education is to be desired, not for itself, but for the use to which it may be put. It is a medium of exchange giving to its possessor the ability to have for himself and others the wisdom of the past and a knowledge of science with its many applications. Unlike money, however, once possessed, it cannot

be stolen or devaluated, but it may be misapplied just as money may be foolishly wasted.

True engineering education must look beyond the problem of teaching subject matter. This is partly because most students must be shown the way from one side of the canyon to the other. Mathematical formulas and the physical laws of the universe are not enough. The intangibles of education, such as personal characteristics, must be included. It is our job to do what we can to go beyond the usual and inculcate those features so ably described by the late President Wickenden in his article entitled "The Second Mile." For those who are not familiar with this article, I recommend it to you.

A recent article in the *New York Times* (Margaret B. Pickel, June 3rd, 1951) has the somewhat startling headline "Education is the Teacher's Job" with the sub-title "The trouble is there are so many 'experts' trying to share it, that they ignore the true expert in the field, the educator." For many years we have been asking men from industry, from business, from almost every walk of life what should we do to save our youth from all types of trouble, most of it imaginary. As a result, I agree with the article in the *Times*, "and surely it must shake the layman's confidence in education to be constantly asked for advice about it. Imagine the waiting room of a doctor on the look-out for surgical suggestions, yet teachers are increasingly taking counsel from outsiders. They ask a panel of business men what they think is the most important part of an education and the business men decide that it is good personal attitudes and work habits, enthusiasm for work, neatness, good manners, tact and punctuality, listing these traits ahead of the basic skills." Have we forgotten that the traits listed are the by-products of a disciplined education and that every teacher worth his pay must consider these in his work. If he does not, then he should leave teaching because the inculcating of these qualities should be the main purpose of our profession. I believe that by diligent work this can be accomplished without sacrificing any content. If some of the "talk-type of training" which requires little thought and less preparation were omitted we would have plenty of time for real training. But it would be hard work for the teacher and frequently harder still to defend it from the purely utilitarian and repetitious get-it-quick methods long advocated by some men who ought to know better.

Lest you think that I am advocating that we as teachers should not pay attention to what our friends in industry and business say, let me enlarge a little by paying personal tribute to the several excellent surveys made by committees of this Society, as well as those made by other organizations, using properly phrased questionnaires and studies of opinion. These are necessary and have proved their value. But they must be well conceived, thoroughly organized and followed up or the results may be worse than if they had not been undertaken. Following the consensus of a good survey is something quite different from being swayed by the opinions of every man who happens to be a loud-talker, without the inhibitions of real knowledge of the subject, and who delights in character assassination by innuendo. For example, I know of one school where a fundamental course of study was altered to suit the whims of a local manufacturer of candy.

Development of Excellence

Think again of education as a way or a bridge across a wide and deep valley, a means whereby something of value is reached leaving ignorance behind. Does this simile mean anything to you ? Is the way clear and bright ? Every bridge has structural members, each a part of the bridge itself and each necessary for its structural unity. As an example of the unity required, I wish to quote from President V. M. Hancher of the State University of Iowa in his charge to the candidates at commencement two weeks ago.

"Education has many tasks and many ends, one is that education in mid-Twentieth Century America should be the development of excellence among all our people.

"The development of excellence implies respect for the best. The development of democracy implies respect for the majority. How can education in mid-Twentieth Century America recognize two masters. Upon what principle or principles can we reconcile the superiority of excellence on the one hand with the consent of the majority on the other ?

"Now the tasks or functions of educational institutions are appropriate tasks in a democratic society attempting to establish economic independence and achieve social unity and cohesion. But, by stressing conformity, by substituting the judgment of the crowd for judgment of the individual mind and conscience, they tend constantly toward mediocrity.

"Conformity is understandable, it is comfortable, it is easy. Usually it represents the average. There is nothing about it that stands out from the crowd. It possesses no sharp edges. It does not invite strange new thoughts, strange new modes of conduct, or strange new patterns of life for the individual. It does not welcome eccentricity. It admires gregariousness, the current cliche, the predictable reaction.

"Democracy, based as it is on respect for human personality and dedicated to the preservation and sanctity of the individual, can easily degenerate into sentimental equalitarianism. This is equality run riot. Starting with the principle that all men are created free and equal in the sight of God and before the law, we end with the foolish notion that all men are identical in their gifts and powers. We begin with the dignity of the individual and we end with *the theory of the interchangeable man.* We end with the theory that men resembling parts of an automobile or of a television set, are equally useful and competent in all the positions in society in which they may be placed, just as inanimate metallic bearings may be shifted from one machine to another without loss or efficiency or precision.

"But men are not machines and there is no such thing as the interchangeable man. In our more reflective moments we all recognize that the two most striking characteristics of human beings are the vast range of their similarities on the one hand and the vast range of their differences on the other.

"The fundamental problem of a democratic society is the reconciliation of respect for personality on the one hand with respect for excellence on the other, the reconcilation of the rule of the majority with tolerance for individual departures from the majority, the reconciliation of the will and the beliefs of the many with the excellence of the few. Democracy must be on guard against the prestige of the composite man—the apotheosis of the average—the man whose beliefs and ideas are a composite of all the beliefs and ideas that he has ever heard, without form or logic and without arrangement or consistency. For a hundred and seventy-five years, we have possessed so many blessings that we have scarcely needed to stress the importance of excellence. But now we stand in a new day. Those who oppose our way of life, and their

satellite nations, outnumber us many times. On a man power basis, we face inevitable defeat in any armed conflict. Our hope lies not in numbers but in excellence. Therefore, the quality of excellence must be our first concern.

"It carries with it a fundamental honesty. When we have inculcated in the members of our society the goal of excellence, we shall have achieved an essential integrity which will make every man his own unkindest critic.

"These are the attributes of excellence—clarity of perception, persistence, self-reliance, ease and grace—the attributes of that excellence which we need so much in these difficult times. How are we to reconcile the attainment of excellence with respect for the average? Is there any ground upon which the two can meet? Must excellence be ever scornful of mediocrity? Must mediocrity always be suspicious of excellence? How can these two—the insights of the superior and the consent of the majority—be reconciled to provide us with a richer and better society?

"The reconciliation seems to call for a twofold interpretation of democracy. On the one hand democracy must inculcate in every member of society that quality of excellence which requires him to work at the highest level of his capacity. On the other hand, democracy must inculcate respect for every member of society who, driven by the desire for excellence, works at the highest level of his capacity. In such a society every member would be useful and every member would be respected. Such a society would be truly democratic. Such a society is needed at this mid-Twentieth Century.

"It was truly said by Bernard of Chartres that 'we are dwarfs standing on the shoulders of giants.' We humans, alone in the animal world, possess history, a kind of cumulative memory, whereby we are able to build on the foundations which others have laid before us. By this device we are able to have at our command all the inventions of ages past. Through this device we have universities and colleges, hospitals and schools, vast foundations and corporations, the principles of representative and of Federal government and the great concepts of Justice, Freedom, Liberty and Dignity of Man, which are basic to our civilization."

I have quoted at length from the address of Dr. Hancher because it fitted perfectly into what I had already written before he gave his charge to the candidates. Now to return to my own wording.

Intelligence and Character

Many have laboured on the bridge and as a result many things have come to us because of the excellence of the past. They are our heritage. They come to us without cost and without price. Our forefathers paid for this inheritance. But this places us under a greater obligation—an obligation that we in turn will make excellence our goal, in order that the rich heritage of the past may be made even richer for the future. The only way in which we can pay our debt to those who preceded us is by making a better bridge for those who falter by the wayside.

If the foundation of our bridge of education is character what about the other parts of the structure which are equally necessary to carry the load of all who wish to cross from ignorance to understanding? I would first put intelligence as the main member, reliability is another and so we could go through the list of desirable attributes of the educated man such as tolerance and justice and knowledge of the world and of the individual, which must be contrasted with the treatment of man as a unit of the state and no value except as he conforms to the wishes of the state.

In conclusion, let me point out that the bridge permits going both forward and backward. We must be ever on the alert to see which way our students are likely to go. Mere mental exercise is not enough; just as a man walking back and forth on the bridge will not get him to the other side, so intellectual dilettantism will not produce results.

Our way, our method, our medium for progress requires a strong structure to stand the strains of the multitude who wish to cross, affected as they will be by the winds of adversity and the frosts of an inhospitable world; a bridge on a firm foundation, constructed with good materials, all welded together by science and technology, tempered with human kindness and love will enable us as teachers to be of value to our students. That is what is expected of us as men and women dedicated to a most challenging profession, namely that of being teachers of Engineering. Education is a way, a method of achieving certain desirable goals. May the whole structure show excellent craftsmanship. May our Society be ever alive to its responsibilities. ✓

VANCOUVER ISLAND

Invites You

The Vancouver Island Branch of the Institute are making detailed arrangements for a brief post-annual-meeting visit of delegates to Vancouver Island. The meeting concludes Friday evening, May 9th, in Vancouver.

Several alternatives are contemplated.

1st: Cross on the midnight boat from Vancouver, Friday night, reaching Victoria 7 a.m. Saturday, and later following routine of Trip No. 3.

or

2nd: Take day trip to Victoria, leaving Vancouver 11.30 a.m. Saturday, arriving Victoria 3.45 p.m. Conducted tour to points of interest in Greater Victoria. Dinner in Crystal Gardens, dancing if desired. Leave on midnight boat for Vancouver.

or

3rd: Same as Trip No. 2, except that instead of returning Saturday night to Vancouver, you stay in Empress Hotel, Victoria, and go over the famous Malahat Drive to Nanaimo (70 miles), crossing Sunday afternoon back to Vancouver.

The approximate all-inclusive cost of Trip No. 2 is only $15.00, and of Trip No. 3—$25.00. Trip No. 1 should cost no more than Trip No. 3.

The Vancouver Island Branch Executive are most anxious to get some idea of approximate numbers coming to the Island, therefore if you are interested please write for full particulars to:

COMMANDER P. F. FAIRFULL,
Sec.-Treas. V.I. Branch, E.I.C.,
Esquimalt Graving Dock,
Box 248, Victoria, B.C.

An Air Conditioning Plant with Medium Pressure Ducts

by

Karel R. Rybka, M.E.I.C.
Consulting Engineer,
Toronto, Ontario

This is a step-by-step description of the basic considerations, studies and tests that preceded the design of heating and air conditioning plants for several buildings in Toronto, among them the Bank of Nova Scotia, one of the largest Canadian office buildings. It is equipped with a variable pressure steam heating system and an all-year air conditioning system. The air conditioning plant was designed like a conventional zoned system, but uses high temperature differences between room and air supply and air is distributed at high velocities, which, however, do not reach those of earlier high pressure air distribution systems.

This system has been specially developed for and has particular adaptability to Canadian conditions.

The Problem:

In 1947 and 1948 the author was commissioned to report on the economics of all-year air conditioning for several proposed rental office buildings in Toronto that would contain from 7 to 25 floors of 15,000 to 20,000 sq. ft. each. The solutions were fitted to local conditions, but should have general application. Toronto's climate offers design conditions for summer cooling that equal those of such favoured localities as Portland, Me., or Burlington, Vt. There is also a plentiful supply of cheap, cold water, only infrequently rising for brief spells above a temperature of 55 F.

In rental buildings only little summer cooling has been done, even recently, and then it used air cooled by city water. Of necessity, it was thus restricted to air handling methods circulating large volumes. This design was favoured by the tower design of most of the recently erected rental buildings; they contain on each floor only a small rental area that can be reached readily from central air shafts or suitably located conditioners on the floors, without appreciable loss of rentable area or ceiling space.

A rental building that is erected at present high costs must still compete with the rentals of older buildings that were constructed at lower unit costs and during the last decade sometimes able to write-off considerable of the investment in them. If, in addition, some of the old buildings boast of air conditioning, including summer cooling, then the value of all-year air conditioning for a new building must be carefully considered.

An air conditioning plant is justified only if it will give maximum performance at minimum first cost, and at the same time will require only negligible rental space, both vertically and horizontally. The solution developed permitted equipping two of the buildings that were under advisement with all-year air conditioning. These are the head office building of the British American Oil Co. and the new head office building of the Bank of Nova Scotia, the subject of this paper. Other projects were postponed to comply with the defence program.

General Design of Building

The Bank of Nova Scotia building is placed on a lot about 232 by 162 ft. and contains two basements and 26 storeys above grade. The basements are the full size of the lot. About half of the lower basement is allotted to boiler plant, refrigeration plant, air conditioning machinery for basements and main banking room, other mechanical and electrical equipment, stores and workshops. The remainder of the lower and the entire upper basement houses vaults, a large banking room, conference rooms and other space for the use of the bank.

The ground floor is only slightly smaller than the basements and is taken up by the main banking room and lobby; these penetrate through large parts of the second and third floors, leaving there only limited rentable or general office areas. Air conditioning of all banking rooms, vaults and associated rooms was a matter of prestige. Their monumental treatment provides room in walls and ceilings for conventional entirely concealed heating and air conditioning systems.

Of the remaining 23 floors, the fourth was assigned to dining rooms, kitchens and social areas; the fifth is unsuitable for general office use as it is broken up by the trusses that carry the building over the wide span of the main banking room; the 26th is a penthouse without elevator service and with few windows. Part of the fifth or truss floor and of the penthouse were therefore assigned to air conditioning equipment and to other machinery. This leaves twenty floors of general offices. It was decided to air condition the lower ten floors and such of the general office areas below the fifth floor as require it from a plant located in the truss floor and to serve the upper ten floors from the penthouse.

Zoning of General Office Floors

The L-shaped plan (Fig. 1) of general office floors creates major

exposures to sun and weather on east, south and west walls, and a lesser exposure at the north end of the building. The width of the building, from 60 to 100 ft., isolates a large central area on each floor too far from the outside walls to be affected by the weather, particularly where private offices are placed along these outside walls. The air conditioning plant is therefore subdivided so that in each of the sections of the building, one served from the fifth floor, the other from the penthouse, a separately controlled central conditioner serves each of the three major perimeter zones and the two central zones. Temperature conditions in each zone are automatically controlled by averaging the effects of several instruments placed in key rooms.

The heavy structural floor beams force the use of vertical risers in each bay of the building, rather than main zone risers with horizontal distributing ducts. To conserve floor space and for appearance, the size of the risers was selected to be not more than that of the enclosures around the electrical conduits, storm water stacks and other pipes.

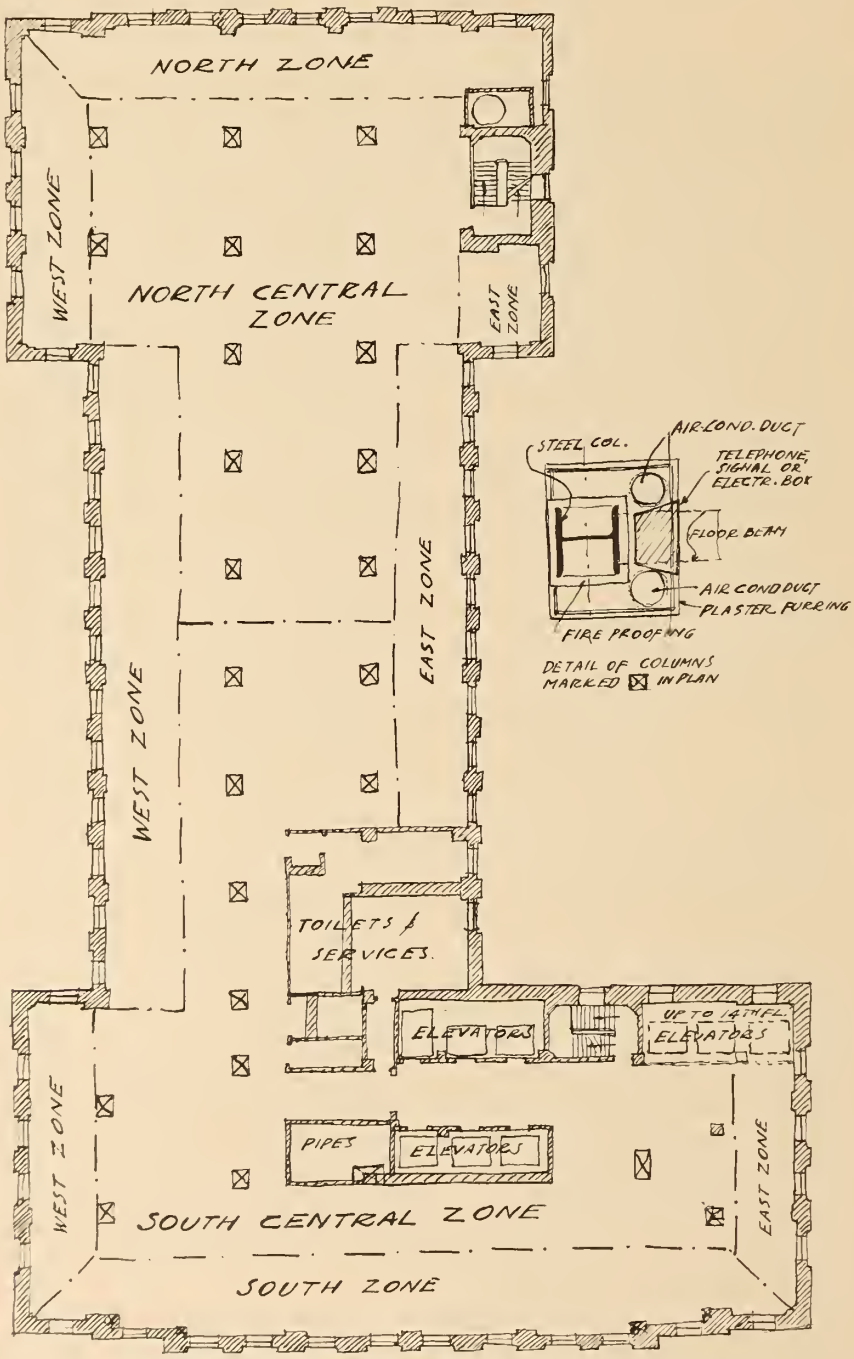

Fig. 1. Typical floor showing zoning of heating and air conditioning.

Limitations of Existing Practice

Restrictions like these have been occasionally met by high-pressure air conditioning installations. In these proprietary systems a small amount of carefully conditioned fresh air is supplied by a central conditioner, but circulation and distribution of conditioned air in each room and much of the heating and cooling of air is provided by circulatory and heat transfer equipment, or after-conditioners, within the room and usually concealed in window recesses. This may ensure a reasonable first cost in hotels, hospitals, public service offices and similar buildings that have only perimeter rooms of similar size which share the outside walls, windows and exposure, and where interior spaces are used only as waiting rooms, washrooms, bathrooms and the like. The after-conditioner then occupies only the space usually allotted to the usual heating unit.

In rental buildings like the Bank of Nova Scotia, however, this scheme introduces serious problems in the core areas, which involve about half the rentable floor space, are to be used extensively as work spaces and offices, and are often densely populated. If a high-pressure system were employed here, it would be necessary to provide costly and space consuming after-conditioners in each of the inside offices also and to do it so as to permit the changes that arise from replanning of the suites. It also requires risers and branches carrying fresh air, and heating and cooling water and drain risers to all parts of the building with horizontal branches and connections that reduce the floor space, and thus reduce, rather than enhance, the rental value.

An alternative solution suggested the use of high-pressure systems for the perimeter of the building, and of conventional air conditioning systems for the core. This was not much better. It was therefore decided to break with current trends, and to resort to a more promising compromise by streamlining a conventional design to a point where it could substantially match high-velocity air conditioning systems, but would do it without after-conditioners, and that would further employ commercial equipment and trimmings mainly, rather than the expensive and highly specialized machinery used in the high-pressure plants.

Basic Design Conditions

The summer demand determines the quantity of air handled in an air conditioning system. The accepted outdoor summer design conditions for Toronto are 73 deg. F. wet bulb, at 90 deg. F. dry bulb temperature, for which about 77 deg. F. dry bulb indoors has been found satisfactory; for the ideal effective summer temperature of 71 deg. F. the American Society of Heating and Ventilating Engineers Guide recommends about 62 deg. F. wet bulb temperature indoors. This condition was plotted on the psychrometric chart. Estimating that three grains of moisture per pound of air will be supplied by the occupants, it was found that the required indoor conditions could be maintained without local after-cooling if sufficient nearly saturated air at about 51 deg. F., 26 deg. F. cooler than room air was supplied to the occupied spaces (Fig. 2).

To ensure the desired temperature, the sensible heat gain of the offices due to human occupancy, lights, sun, etc., required an air supply of about 0.63 cfm. for each square foot of office area, or an average of four air changes per hour.

If fresh air only were supplied, it would be several times the usual fresh air requirement of the occupants and it was therefore decided to recirculate half of the air supply, so as to avoid the expensive conditioning of unnecessarily large air volumes and particularly to eliminate the expensive, and in northern winters very demanding air preheaters. Between five and six air changes per hour are considered desirable for air movement sufficient for comfort; the difference between the air actually supplied and the desired comfort air change was to be provided by the aspirating effect of the air supply fittings. The excess of air supply into the building over the recirculated air quantity is partly exhausted through washrooms, rest rooms, kitchens, etc., and in part it serves to hold the building under a slight internal pressure, in order to reduce infiltration of air from outdoors.

In a conventional air conditioning plant it is customary to distribute air at velocities of from 1800 to 1000 ft. per min. in main ducts, and down to perhaps 500 ft. per min. in branches. For a ceiling height under 10 ft., it is usual to introduce air about 15 deg. F. colder than room air. It was decided to use here more than double the conventional air velocities in ducts. Thus with air 26 deg. F. cooler than room air, the cross section of ducts was reduced to one-quarter of the conventional sizes.

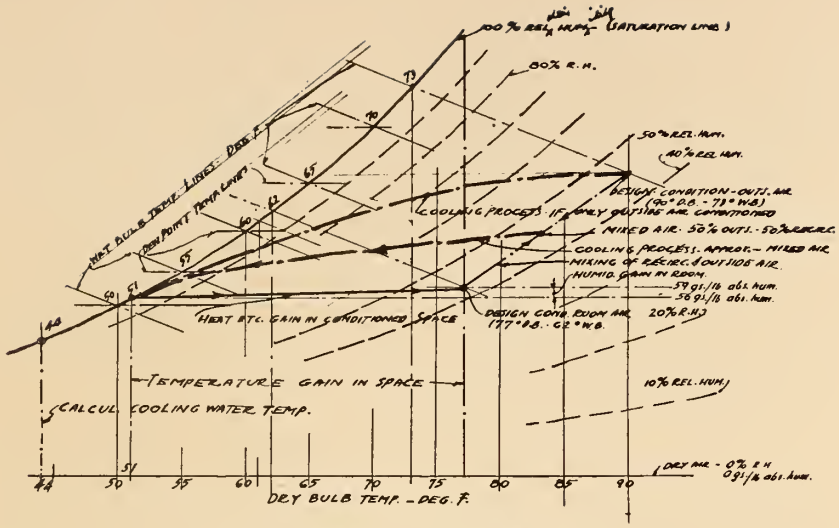

Fig. 2. Diagram of cooling system.

These extreme conditions made it desirable to look for some methods that would allow meeting the changing load demands readily. This design was greatly influenced by consideration of the inside areas of the building. There, regardless of outdoor conditions and weather, the conditioning problem is at all times linked with cooling, and the air supply will always need to be below room temperatures, but as shown above, within 26 deg. F. of it. The air distribution can then be adjusted very closely for best results and will not be affected by widely fluctuating supply air temperatures. Automatic controls become simpler, more flexible and more accurate. The conditions that obtain in inside areas can be effectively simulated in the perimeter rooms through a heating installation which is independent of air conditioning, and that is capable of offsetting heat losses through the outside walls in winter weather.

In cold climates a direct heating system is necessary and has, for several reasons, been generally used with good air conditioning plants; it maintains reasonable temperatures during the three-quarters of the time in winter that the building is not occupied, at much lower operating cost than is possible with such an air conditioning system alone; it eliminates the downdrafts from windows and outside walls that always occur, regardless of the quality of windows and that are accentuated by air conditioning; it contributes to comfort and to rental value; it also provides a stand-by plant in case of inability to operate some parts of the air conditioning system. Steam convectors of sufficient size to compensate for transmission losses, are therefore provided but, to keep costs to a minimum, they do not consider infiltration of outdoor air into the building through leaks around windows, etc. They are automatically controlled by outdoor weather from a central location on the roof.

Selection of Air Diffusers

The early building designs indicated that the probable smallest unit of space to be air conditioned would be about 9 by 12 ft., and that the clear ceiling height would exceed 9 ft. Tentatively the largest area served from one diffuser was therefore set, because of the limited ceiling height, at approximately 140 sq. ft., with an estimated air supply of 90 cfm. The specification for the diffusers was deliberately drafted demanding much more than was required to meet the calculated conditions. They were specified to supply without noticeable drafts from 60 to 90 cfm. of air at 28 deg. F. below room temperature to a room 9 by 12 ft. with only 8 ft. ceiling height. The diffuser was further required to be free of objectionable noise, and to assure an aspiration of at least one part of room air into the air stream for each three parts of air supplied by the system. The increased temperature difference was to allow for unusually heavy demand, and the low ceiling was selected in the expectation that draftless and reasonably noiseless introduction of air at that height would ensure a desirable margin of safety with the available greater ceiling height.

From past experience it seemed

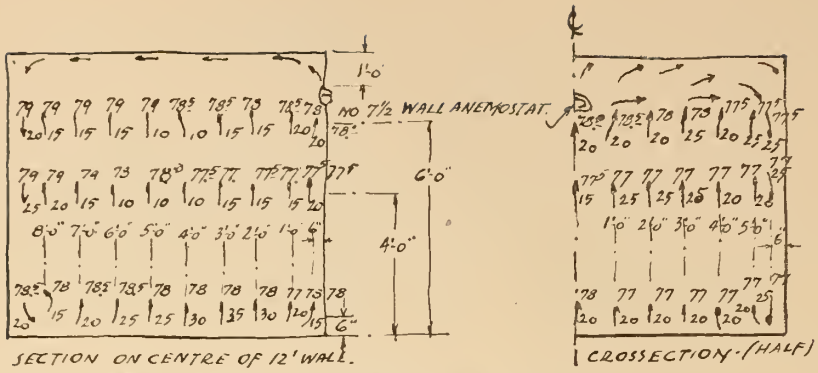

Fig. 3. Test data—wall anemostats.

probable that Anemostat diffusers would fulfil these conditions. However, the manufacturer was unwilling to guarantee the specified performance and comprehensive performance tests were therefore made with ceiling and wall type Anemostat diffusers under the conditions outlined. The highlights of the test results are summarized in Figs. 3 and 4 and are self-explanatory. The temperatures in the room were uniform within fractions of a degree. The recorded air currents were well below those that might cause discomfort, but were sufficient to ensure proper circulation of air through all parts of the room. Temperatures and air velocities were measured with electronic instruments. The air movement was observed by introducing smoke into the air stream near the diffuser. The aspiration effect was estimated from a comparison of the quantity of air passing through the supply duct with that calculated from air speeds obtained on the outside of the Anemostat. Actually, an aspiration of 35 percent of room air into the air stream was estimated.

Particular attention was paid to possible downdrafts on walls that are objectionable mainly where they are deflected by horizontal ledges, tops of furniture and files. The measured air speeds showed freedom from these downdrafts, and this was confirmed by placing observers in the path of the expected currents. Comprehensive noise level measurements were first planned, but, in view of the satisfactory performance of diffusers at the desired air delivery, they were not carried out. It was apparent without extensive tests that only little air-rush noise occurred, except when the baffle fittings, used by the manufacturer for volume and flow control, were used. It has, however, been decided to use special "valves" for volume control in any event.

Since these tests were made, architectural reasons led to the adoption of a square pattern of ceiling type Anemostat. Further tests were made on this pattern, but they were less comprehensive and served mainly to show that they performed as well as the round fittings.

Duct Design

Most of the ductwork in this medium-pressure air distributing system is of circular cross-section except for some ducts near fans and the conventional recirculating ductwork, which are of rectangular cross-section. Ducts are of the usual weight of galvanized sheet steel and all supply ducts have soldered seams to guard against air whistle through pin holes.

The design of duct systems was governed by the limitations of size of duct risers, permissible noise and the desire to use standard fan equipment and accessories. The vertical duct risers were limited by standardizing the outside measurements of certain rows of building columns and wall piers on each floor (Fig. 1) so so that each could conceal two insulated pipes or ducts of at most 8½ in. external diameter Fig. 5. The available duct locations dictated that about 200 sq. ft. of floor area through nine and in part through ten floors be served by one duct riser, and this resulted in a maximum air velocity of 3000 ft. per min., therein; the air velocity tapered off toward the end of the riser and in the branches to diffusers to about 1100 ft. per min.

To permit usage of fans of Class 2 commercial construction, a total external pressure loss of 6 in. of water was fixed for all fans. This led to an allowable pressure loss of 0.1 in. of water in 10 ft. of duct, with resultant air speeds near the fan and through fan outlets of 3500 ft. per min.

Previous experience indicated that, unless these air velocities and pressures and corresponding fan speeds are exceeded, no serious noise troubles will arise, as long as reasonable care is taken in the construction of ducts, branches and fittings to avoid abrupt changes of cross-section. The reduction of air velocities in the branches to secure the desired quantities and velocities

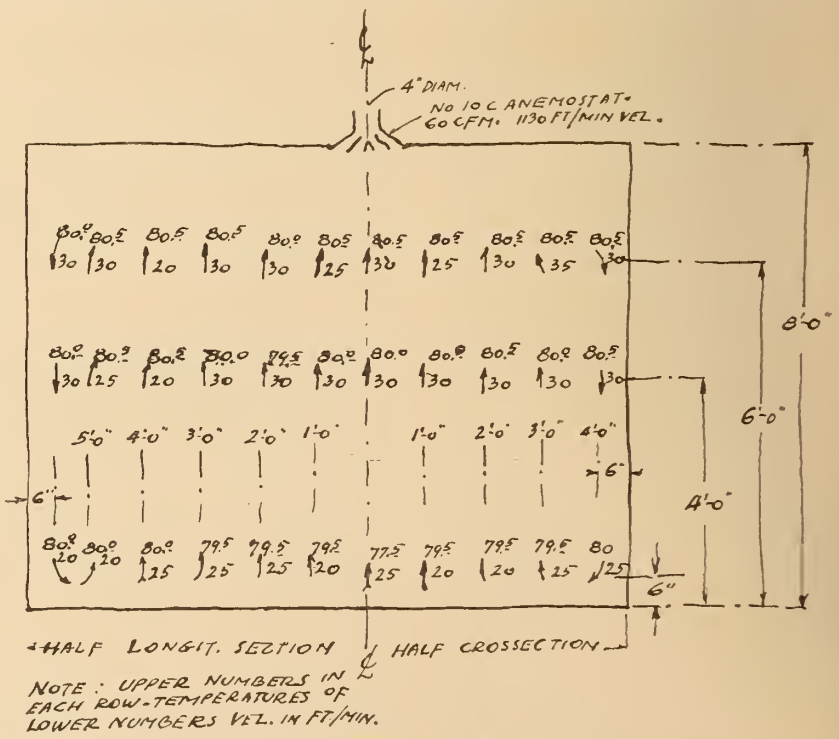

Fig. 4. Test data—ceiling anemostats.

at diffusers is secured by means of inexpensive streamlined manual valves (Fig. 6) that are adjustable through diffuser connection and were designed specially for this type of installation. A similar, but thermostatically controlled and air operated, valve was designed specially for this type of plant for use in spaces where more exacting control was desired than that given by zone control. These valves were built in part from standard components. They were tested before acceptance as to throttling effect and noise.

Air supply ducts are outside insulated with three layers of corrugated asbestos covering, sealed and waterproofed, to guard against outside condensation. This results in some sound deadening, and the main ducts need therefore to be sound insulated on inside with a fibreglass blanket only to the same extent as in a conventional air conditioning system viz: for about 30 ft. from the fan discharge. The early tests also indicated that a few supply outlets near the fans passed a noticeable hum into the rooms; this was overcome by a short, flexible sleeve made of ½" thick insulation (also shown in Fig. 6) at the affected outlets.

Some serious noise troubles were averted by the co-operation of the fire underwriters and the municipality. The self-closing fire dampers that are usually required where air ducts pass through floors or other fire barriers were waived for the entire medium pressure air conditioning system, on condition that only ducts of less that 144 sq. in. cross-section would be carried through the fire barriers, and that some simple, precautionary measures would be observed, mainly in connection with duct insulation.

Outline of Equipment and Refrigeration and Boiler Plant

The air filters, heating and cooling coils, humidifiers, fans and associated equipment are of conventional and commercial design throughout. The air velocities through them except for fan discharges have been kept in the conventional ranges of about 300 ft. per min. in filters and 550 ft. per min. in washers and heating and cooling coils. The refrigeration plant consists of three water chillers with 250 hp. centrifugal compressor - condenser assemblies which develop at the design conditions a cooling capacity of approx. 10,000,000 Btu/hr. Two atmospheric water chillers have been provided in conjunction with condensers. The boiler plant is operated at 30 psi. pressure and contains two straight-tube water-tube boilers, each capable of delivering 18,000 lbs. of steam per hour, and a small boiler for summer load. Pumps, etc., are electrically operated, and two Diesel generators supply some light and minimum power in emergencies.

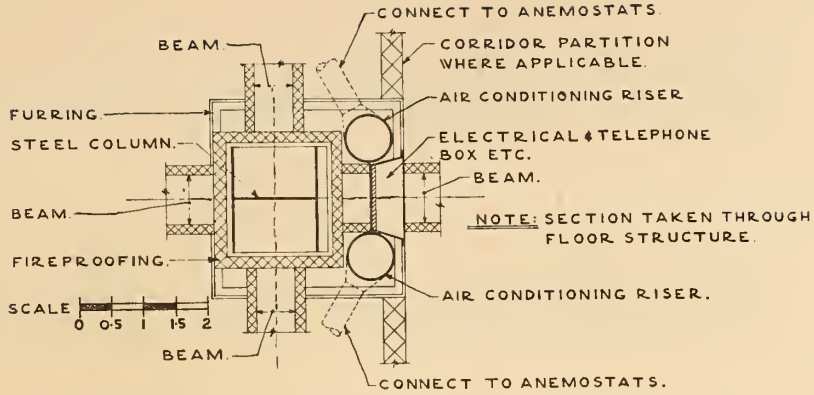

Fig. 5. Arrangement of duct and pipe risers at columns.

First Costs

The first cost of this system was lower than that of a comparable conventional plant of equal performance. In addition the design reduced waste space on rentable floors to a negligible level. The estimated cost for this building of well-known after-conditioners, laid down at the building, and apart from all other plant and services, was as high as the entire cost of the heating plant, except for cost of the boiler room.

Results in Operations

The plant has been through several months of operation and has proven itself in every regard. It has confirmed the validity of all the assumptions and the tests on which the duct design, selection of diffusers and planning of all other parts of the plant were based.

Conclusions

The basic calculations of temperature conditions and of air distribution employed in the air conditioning plant in the Bank of Nova Scotia and in at least one other completed building have shown that groups of about ten floors can be equipped economically with a medium-pressure air conditioning system that employs commercial equipment, and that avoids all the complications that usually arise from high velocity air distribution, and from sensible cooling in the conditioned spaces. If the air conditioning plant can be located on a central floor, twice the number of floors could be served economically by one such system.

This has particular interest in the Canadian scene, where few, if any buildings would exceed this requirement.

Acknowledgments

Architects for the building were Mathers and Haldenby and Beck and Eadie. The structure was designed by Wallace and Carruthers and Associates, the electrical and mechanical consulting engineer was Karel R. Rybka, M.E.I.C. the general contractor was J. L. E. Price & Company, Ltd., of Montreal.

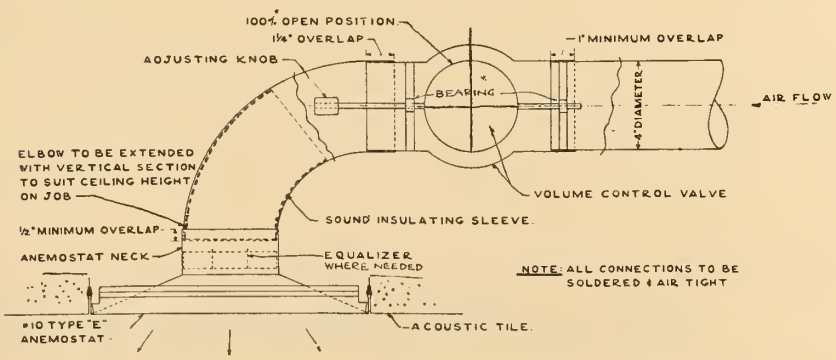

Fig. 6. Special manual control valve.

66th Annual General and Professional Meeting

Arrangements for the 66th Annual General and Professional Meeting of the Institute have been completed.

The meeting place is the HOTEL VANCOUVER in the beautiful City of Vancouver. The dates are May 7, 8, 9—one of the very best times of the year on the Pacific Coast.

The tremendous developments taking place in Canada today make it essential that Canadian engineers get together to hear and discuss the problems and achievements of their profession. No investment of time and money could be of greater value to the engineer and his employers than active participation in this great annual engineering event.

For the ladies' special arrangements have been made so that they will be entertained and will see the city and surroundings while the professional sessions are in progress. Inspection tours of plants and other engineering developments are included in the general program. A special boat trip around Vancouver harbour has been arranged.

Full details will be mailed to all members in the very near future—in the meantime—plan to attend.

This meeting has been arranged for YOU

Outstanding Papers by Outstanding Authors

- **The Columbia Cellulose Plant**
  S. B. Roberts,
  Chief Engineer, Celanese Corporation of America, New York.
- **Instrumentation**
  A. H. W. Busby, M.E.I.C.,
  Consolidated Mining and Smelting Co. of Canada, Trail.
- **Precast Reinforced Concrete Building Frames**
  E. M. Rensaa, M.E.I.C.,
  Main, Rensaa and Minsos, Edmonton.
- **Electrical and Mechanical Features of the Ontario Hydro Steam Plants**
  S. L. Fear,
  Hydro Electric Power Commission of Ontario, Toronto.
- **Rural Electrification in British Columbia**
  Garth Griffith, M.E.I.C.,
  Deputy Chief Engineer, British Columbia Power Commission, Victoria, B.C.
- **The "Otter" Aircraft**
  Phillip Garrett,
  The deHavilland Aircraft of Canada Limited, Toronto.
- **Transmission Line Crossing of Kootenay Lake**
  E. M. Stiles, M.E.I.C.,
  Consolidated Mining & Smelting Co. of Canada Ltd., Trail.
- **Nechako-Kemano-Kitimat Hydro-Electric Power Development and Aluminum Reduction Plant**
  F. L. Lawton, M.E.I.C.,
  Chief Engineer, Power Dept., and
  J. S. Kendrick, M.E.I.C.,
  Assistant Project Manager, Aluminum Company of Canada, Ltd.
- **The Spray River Power Project**
  G. V. Eckenfelder, M.E.I.C.,
  Resident Engineer, Montreal Engineering Company.
- **Corrosion in Industrial Plants**
  Bruce Levelton,
  B.C. Research Council, Vancouver.
- **History and Present Status of Power Development from the Wind**
  H. E. Parsons,
  Head, Engineering Design Section, Radio and Electrical Engineering Division, National Research Council, Ottawa.
- **Trans-Mountain Oil Pipe Line**
  S. M. Blair,
  Vice-president, Trans-Mountain Oil Pipe Line Co.
- **Economic Aspects of Flood Control**
  J. B. Carswell, M.E.I.C.,
  Kitimat Constructors Limited, Vancouver, B.C.
- **R.C.A.F. Research and Development in Canada**
  J. J. Green, M.E.I.C.,
  Defence Research Board, Ottawa.
- **An Integrated Forest Products Operation**
  J. O. McCutcheon, Jr.E.I.C.
  Manager, Alberni Plywoods Division, McMillan and Bloedel Limited, Port Alberni, B.C.
- **Prefabricated Vessels for Inland Waters**
  Arthur McLaren,
  Managing Director, Allied Builders Limited, Vancouver.
- **Log-Carriage Drives**
  D. S. Smith,
  Assistant Director, B.C. Research Council, Vancouver.
- **Structural Timber**
  W. Thornber, M.E.I.C.,
  Timber Engineer, B.C. Coast Woods Trade Extension Bureau, Vancouver.
- **Management, Safety and the Engineer**
  Panel Discussion.
- **The Relative Fields of the E.I.C. and the Provincial Professional Associations**
  Panel Discussion.

Plan NOW to be present!

FROM MONTH TO MONTH

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

Annual Meeting—Vancouver

May 7th, 8th and 9th

All that is needed now is you. Practically all details of the program are completed. The Vancouver committee is ready to greet the visitors and to make this an outstanding and memorable occasion. Your attendance will complete the picture.

The technical program of 24 papers covers a great range of subjects and branches of the profession. The special speakers for the luncheons and the banquet are outstanding. The tours, boat trip, side trips and plant visits are different. Western hospitality is well-known. And as a background for all this there is Vancouver itself sitting on the doorstep of the Pacific and at the foot of the Rockies. You shouldn't miss it.

Vancouver Island Branch (Victoria plus) is inviting members to come there after the meeting. They have arranged a dinner and dance for Saturday night and a drive over the famous Malahat for Sunday. To be on the Island in the month of May is an experience to be remembered.

The banquet speaker on Friday night will be N. R. Crump, M.E.I.C., senior vice-president of the Canadian Pacific Railway. A member of the Institute for 24 years and a great industrial leader, he has an interesting and important message for you.

At luncheon on Wednesday, Mr. R. G. Johnson, president, Defence Construction Limited, will be the guest of honour. His subject will be The Defence Construction Program.

At lunch on Friday there is a treat in store. Professor F. K. Shallenberger of the Department of Graduate Studies, University of Stanford, will speak on "The Push Button Factory". He is not going to talk of how to build or run such a factory but rather of the effects of such operations on human beings. Mr. Shallenberger is associate professor of industrial management. You will enjoy him.

Registration forms and further information will be mailed to members about April 1st. There will be special rates on the railways. It is not planned to run special trains but arrangements will be made to group members together in the same cars. Make enquiries of your ticket agent. You are advised to book early.

The Hotel Vancouver will be the centre of the meeting but persons who cannot be "roomed" there or who prefer one of the other hotels will be well taken care of at the Georgia or the Devonshire, both excellent hotels and just across the street from the Vancouver. Hotel reservations will be made through Headquarters.

Outdoor features of the program include an evening boat trip in and about Vancouver harbour, with a buffet supper; a visit to the University of British Columbia to see the giant size model of the mouth of the Fraser River, which has been built to study the problems of silting; visit to a plywood plant; motor drives in and around the city; golf and so on.

The Engineers' Wives Association of Vancouver is arranging a full and interesting program for the ladies. There will be something going on all the time. On top of all this there are beautiful drives and delightful places to visit. Plan to make this a real holiday. Combine pleasure, business, and professional development in one great program.

Details of the technical program will be found on page 213 of this issue.

Cover Picture

The cover photograph shows an ingenious welding fixture recently developed by the Lachine plant of Dominion Bridge Co. Ltd. for the purpose of quickly and efficiently welding inside long tubes, drums and similar components. By its use work of 18-in. diameter (or more) and up to 20 ft. long can be welded both circumferentially and longitudinally, using the submerged arc process. The machine is capable of welding gauge plates as well as heavy plates with no limit as to thickness. An infinite number of speeds, ranging up to 200 inches per minute, can be obtained.—*Photo courtesy Dominion Bridge Co. Ltd.*

A Distinguished Guest from Great Britain

The officers of the Institute at Montreal had the honour to entertain at luncheon on February 14th Dr. William Abbott of the British Ministry of Education. Dr. Abbott is becoming well known in Canada because of his association with the Athlone Fellowships. The current visit is his third in three years.

Once again he comes to sit with examining boards at the various universities to select the winners of fellowships for 1952. By the time he had reached Montreal he had completed his sittings at Nova Scotia Technical College at Halifax, University of New Brunswick at Fredericton and University of Laval at Quebec. He will cross Canada to the west coast to visit all universities that grant degrees in engineering.

It has been the Institute's privilege to entertain Dr. Abbott on each of his visits to Canada, and it will be a pleasant prospect to look forward to similar occasions in the future. Other guests at this year's luncheon included the full examining boards for McGill and Ecole Polytechnique, also Mr. J. Thomson, the United Kingdom's Deputy High Commissioner to Canada; General the Honourable A. G. L. McNaughton, M.E.I.C. was also present; J. B. Stirling vice-president for the area presided.

Dr. Abbott spoke of the experiences of the Canadians who went to England in 1951 on Athlone Fellowships. He reported that all were happy and greatly interested in their studies and their practical experience. Also they were seeing as much as possible of the country itself. He reported too that the employers were greatly pleased with the Canadian product.

Centennial of Engineering

This year the American Society of Civil Engineers celebrates the 100th anniversary of its founding.

A great convocation of engineers will take place to mark the occasion. The locale will be Chicago. The dates are September 3rd to 13th.

The Engineering Institute has been invited to join with a host of American societies to arrange and to participate in a program of great breadth and significance. So large is the undertaking, so far are its ramifications that a separate corporation known as The Centennial of Engineering Inc. has been created to handle it. A full time staff of wide vision and experience has the arrangements in hand.

The specific aims of the conference as set out in the official literature are—

1. to dramatize effectively for the public the principles which have produced the leading nations of the world and to point the way to further development.
2. to acquaint the public with the part played in this development by the engineering profession and progressive management.
3. to attract qualified young men to study engineering to fill the future's great need for technically trained men in industry.
4. to personalize the engineer in his true role.
5. to hold the world's greatest convocation of engineers.

In the minds of many the greatest value of the ceremony will be the opportunities it affords to impress the public with the work done, and the achievements brought about by the engineer. This is to be a feature throughout the program. There will be stage presentations daily throughout the summer, an integrated exhibit that will continue for five years, radio and television shows, special books for school children, feature stories in the press, a special postage stamp and so on to bring to the public the story of man's progress through engineering.

With these thoughts in mind Gano Dunn, President of the J. G. White Engineering Corporation has said "It is fitting that we celebrate this centennial not only for our own satisfaction but to set forth to industry its victories and to attract young minds into the continuation of those victories."

Ralph Budd, Chairman, Chicago Transit Authority has expressed his observations on this aspect of the centennial thus—"Presentation of the facts regarding our total industrial organization must be made by non-partisan sources; otherwise the clamor of pressure groups harboring selfish interests will drown out the truth.

"The engineering profession is a non-partisan source of information, respected by the public, devoted to the highest ideals, and capable of administering a program of highly educational value.

"The Centennial of Engineering provides the opportunity of a lifetime to tell the story of our advancement to oncoming generations."

Over 40 societies are joining in the programme to do honour to the senior member of the group, the American Society of Civil Engineers—There will be professional sessions for all branches of engineering. There will be numerous occasions for all to meet together—receptions, lunches, banquets, panel discussions and so on.

It is planned to be and doubtless will be the largest gathering of engineers ever held any place in the world. It is well identified as The World's Fair of Engineering.

An impressive list of names is associated with the project. Charles F. Kettering of General Motors is chairman of the executive committee and the board of directors sounds like a "who's who" in American engineering and industry.

The hotel headquarters for Institute members will be the Conrad Hilton (formerly the Stevens) where a block of rooms has been reserved. Shortly the *Journal* will publish a draft of the program so that members will be able to determine the dates upon which they wish to attend.

Inspiration for the Young Engineer

One is inclined to be cross with persons who thoughtlessly make public pronouncement on the engineer's failure to take his post in public life. It is the contention of this writer that by and large, the engineers make just as good a showing in public service as does any other professional group.

Recently the officers of the Institute under the chairmanship of vice-president J. B. Stirling, had the honour of entertaining at dinner a distinguished American engineer whose record is a glittering example of service to the public and the community. How many people can be found to equal the performance of Senator Ralph Edward Flanders? Young engineers can see in this, the

many opportunities there are to serve, and at the same time to be successful in the profession. Now take a long breath and read the following which is taken from "Who's Who in America".

Senator Ralph Edward Flanders

A.M., Dartmouth, 1932; M.E., Stevens Institute, 1932; D.Sc., Middlebury (Vt.) College, 1934; D.Eng., Rose Polytechnique Institute, Terre Haute, Ind., 1935; D.Eng., Brooklyn Polytechnique Institute, 1934; University of Vermont 1935; Norwich University, 1939, Northwestern University, 1940; Machinist apprentice and draughtsman, Providence and Woonsocket, 1897-1901; designer International Paper Box Machinery Co., Nashua, N.H., 1903; Associate Editor Machinery, New York, 1905-10; engineer Fellows Gear Shaper Co., Springfield, Vt., 1910; became director and manager, Jones and Lamson Machine Co., Springfield, 1912, President since 1933; president Bryant Chucking Grinder Company; director Lovejoy Tool Co., National Life Insurance Co.; president Federal Reserve Bank of Boston since 1944. Trustee Norwich University, Northfield, Vt.; trustee Goddard College, Plainfield, Vt., 1938-40; member corp. Massachusetts Institute of Technology; member business advisory and planning council of United States Department Commerce 1933; also member Industrial Advisory Board of NRA, Advisory Board for the Subsistence Homestead Administration; administrator Machine Tool Priorities, Office of Production Management, Washington, D.C., 1941; member Economic Stabilization Board, 1942-44; chairman Machine Tool Co. of Combined Production and Resources Board, 1943; chairman Screw Thread Standardization Board of American Standards Association until 1944; chairman research commission and trustee commission for Economic Development. Member National Screw Thread Commission, 1920-24; director Social Science Research Council, 1932-36; member American Engineering Council (v.p. 1937, Hoover medal 1944); President New England Council, 1941-42; 1934, president American Society of Mechanical Engineers. National Machine Tool Builders (president 1923), Academy Political and Social Science, American Economic Association, Boston Chamber of Commerce, Honorary member, Massachusetts Institute of Technology Chapter of Tau Beta Pi and American Society of Mechanical Engineers. Author: Gear Cutting Machinery, 1900; Taming our Machines, 1931; Platform for America, 1936; Co-author of Toward Full Employment, 1938; also author numerous technical papers. Senator from Springfield, Vt.

Ecole Polytechnique Still in the Lead

Early in January, Headquarters received 105 applications for Student membership from Ecole Polytechnique, Montreal. For many years this university has headed the list in percentage of enrolled students who belong to the Institute. This leadership applies to all years, not just to the graduating class.

In acknowledgment of Polytechnique's outstanding performance, and in the hope that it may inspire others, a table is appended which shows the details. Even a quick glance will reveal a startling record.

In the fifth or graduating year, 95.5 per cent of the entire class are student members. Even in the second year 63 per cent are members. Just look at the figures! In five years or more Polytechnique has led all Canada with a final year average of slightly more than 98 per cent. It shows what can be done by the students with the sympathetic support of the faculty. In this case the students were Marcel Dufour and Pierre Brosseau, and the sympathetic support came largely from Professor Leonard Cartier.

Standing of E.I.C. Student Membership at Ecole Polytechnique

December 21st, 1951

Year	Number of Students	Membership			Percent of Students				
		Previous	New	Total	1952	1951	1950	1949	1948
					%	%	%	%	%
2nd	130	13	69	82	63.0	45.5	56.3	27.6	27.6
3rd	76	35	22	57	75.0	74.6	58.5	56.5	63.0
4th	83	58	3	61	73.5	81.3	82.7	79.5	95.0
5th	78	65	11	76	97.5	95.8	98.8	98.5	100.0
First year excluded	367	171	105	276	75.3	73.6	73.9	57.7	68.5

The McCharles Prize

One Thousand Dollar Award for Invention or Research

This prize, gift of the late Aeneas McCharles, is given for the discovery of improved methods of treating Canadian ores or minerals, for the development of new life-saving devices in the power and light industry, or for notable achievements in scientific research in any useful practical line.

Conditions of Award

The McCharles Prize is awarded:

(1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale;

(2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light;

(3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line.

Nomination of Candidates

The Committee appointed by the Board of Governors of the University of Toronto to recommend the award of this Prize will consider recommendations from time to time as received.

Candidates must be proposed in writing by some qualified person other than the candidate and supported by a second such person familiar with the circumstances. Sufficient proof must be furnished to satisfy the Committee as to the importance of the accomplishment on which the recommendation is based.

Forms for nomination may be obtained upon application to:

Mr. C. E. Higginbottom,
Secretary,
The McCharles Prize Committee,
University of Toronto.

The Montreal Branch Committee on guidance brings highschool pupils to the Institute to hear about engineering as a career. Col. L. F. Grant was the speaker. (There are a couple of ringers on the left.)

•

At right, Colonel Grant (left) and Walter Wong, of the Montreal Branch Student Guidance Committee.

C.C.A. Meets in Toronto

Meeting at Toronto from January 20th to 23rd for their 34th annual convention, the Canadian Construction Association elected Percy G. Wilmut of Montreal as their National President for the next two years. Membership in the Association now stands at 883, while attendance at the meeting exceeded 1000 delegates. The opening day, Sunday, was devoted to registration, a luncheon for secretaries and managers of the 19 Builders Exchanges from cities across Canada, and a meeting of the management committee of the Association.

Committee Reports

The Monday morning session was, as usual, devoted to Committee Reports. Chairman Drummond of the Materials Committee, forcasting that steel supplies might be tighter in 1952, believed the outlook for 1953 would be brighter. Thirty per cent more steel had been available for all industry in 1951, and a further 8 per cent would be added this year. The supply of heavy structurals would be particularly tight for some time to come. Shortages for some non ferrous metals would likely continue past 1953, and some shortages in cement, nails and other materials would again occur during the summer. The committee recommended re-endorsation of the Association's firm price policy adopted last year. It also urged that in line with large scale expansion programs in steel and cement, manufacturers of other construction materials should plan now to keep pace.

J. M. Pigott, chairman of the Apprenticeship Committee, pointing out that on the same ratio as in Quebec, 35,000 trainees yearly would be required in the other nine Provinces, stated such an unrealistic total was not proposed by the committee. On a 10 to 1 ratio, 15,000 would be needed,—or for Ontario alone 8000, of which 2000 are actually in training. Ontario's Minister of Labour, Hon Charles Daley, he reported, will hold a conference in March to lay down plans for Ontario to bring skilled trades into line with current and future demands. Outlining current apprenticeship progress in each province, he urged that the Association should face the task of keeping apprenticeship training in step with the demands of the industry, with all the vigor and realism at its command.

Chairman Rutley, M.E.I.C., of the Equipment Rentals Committee, reported that a C.C.A. rental schedule, giving monthly rental rates ex-

pressed as a percentage of current replacement values, was now under active preparation, and the completed document should be in the hands of members in the spring of 1952.

Defence Construction

During the morning session, delegates also heard a short address by R. G. Johnson, president of Defence Construction, on leave from the position of general manager of the Association, who told them that direct defence construction spending was now at a rate 40 per cent higher than for 1951. Defence expenditures, he reported, will approach $200 millions during the current fiscal year, or nearly double 1951. Contract awards will total about a quarter of a billion dollars, 50 per cent in the two central provinces, 25 per cent on the prairies, 12 per cent in the maritimes and 7 per cent in B.C. These totals do not include married quarters for armed services, airport construction by Department of Transport, or capital assistance.

Defence Construction, he stated, will employ an average field force in 1952 of some 15,000 workers. It will use 4000 tons of reinforcing and 1,500 tons of structural steel monthly, up 25 and 50 per cent respectively over 1951, and this will cause some local shortages. Pointing out that the defence program was not large enough to completely offset decreases in residential and other construction halted by lack of materials, Mr. Johnson suggested that firms not qualified financially or by experience to undertake large projects might profitably team up to bid on a joint venture basis.

Retiring President's Address

At the opening luncheon meeting on Monday, delegates were welcomed to the city by His Worship Mayor Allan A. Lamport of Toronto. In his presidential address, retiring President Robert (Bob) Drummond, M.E.I.C., of Toronto predicted that the year 1952 would prove to be the biggest construction year the Industry has yet had to face.

Admitting that Canadians have a right to be proud of the great strides being made in our nations development, he warned that we must not become complacent. Today, he pointed out, our exports include a greater percentage of raw materials and semi-finished goods than in 1939; we are importing relatively more fully manufactured goods than in prewar years. Thus we are more truly "Hewers of wood and drawers of water" than in prewar years.

Canadians, he warned, must direct their attention to further developments and "think big", with a proper perspective. This means thinking in terms of more population and more attention to providing it with the many skills needed for a complex industrial economy; it means continuing development and conservation programs for our resources; it means secondary and tertiary industries on a larger scale; and greater processing of our own raw materials. The results will be seen in a more balanced economy and a higher standard of living.

Ordinarily, engineering construction comprises nearly half the total annual volume, with housing accounting for another third and the balance commercial and industrial. Last year contract awards totalled $2.3 billions, a 50 per cent increase over 1950. Final figures will show a 1950 total exceeding $3 billions. The preliminary estimate for 1951 exceeds $3½ billions. This adds up to a terrific strain on present resources.

Beyond 1952, the present capital investment program, particularly that connected with basic industries, will lead to the establishment of secondary industries, new townsites and all the accompanying necessities, etc. He cited, for example, the potential industrial development following upon the completion of the Seaway and the power involved with it. We must all raise our sights, he stated. Material manufacturers must keep pace with the current expansion in the steel and cement. Apprentice training must be speeded up.

Spokesmen for these groups appear to be optimistic, he said, but wide vision and bold action will be required. Canada's future represents a security we may all bank on. Any lack of confidence that exists for the future appears to result from the fear of recurrence of the depression of the "thirties". Canadians, he observed, are too depression conscious. Canada possesses sufficient natural wealth to support a far greater population, and to provide employment to all those able to work.

Turning to the question of labour relations, the speaker observed that while they are by and large relatively responsible in character, conditions are changing. It may well be that some long established Union practices should undergo alterations. For example, the establishment of Union rates in early days served to increase tradesmen's earnings. Today this often serves to decrease the earnings of industrious workers. Employees on some projects have reaped rewards by a wage system which includes compensation for greater effort. Incentive systems have been established with full Union approval in Britain and in most European countries. The time seems appropriate to give their experience careful study with a view to introducing such a system in general building construction here.

In conclusion, what greater incentive is there, he asked, than to share in the development of one's country, and to participate in the ensuing rewards? We have but started on the fringe of a development of resources of unprecedented proportions. Let us not forget the vital contributions of hard work and free enterprise. Not only will our activities build up our heritage; they also are the best means of protecting that heritage. Military strength is based on economic strength.

Canada Must Have Seaway

The guest speaker at the annual banquet was the Hon. Lionel Chevrier, Minister of Transport. Warning that the St. Lawrence Seaway was an "urgent must", he declared that Canada was determined to override the powerful minority interests that have denied it to us these past 20 years and more. Parliament, he said, had already passed an Act creating a Seaway Authority, and has approved an agreement with Ontario for development of power on the International Section.

There was no thought, he assured, of the Authority undertaking anything that can be done as well or better by private firms in the construction industry. The intention is to call tenders for as much of the work as possible, and this should mean the greater part. Steel requirements will slightly exceed 2 per cent of Canada's annual consumption and cement 4 per cent. The average labour force required would be some 15,000 on an assumed 5 year schedule, some 9,500 of whom would be employed in Canada.

Federal Aid for Highways

The Hon Errick Willis of Winnipeg, past president of the Canadian Good Roads Association, addressing the Road Builders luncheon meeting on Tuesday, made a strong plea for revision of the Canadian system of financing road construction. If we could assure a reasonably uniform and continuing program in all provinces, he said, in place of the present alternate feast and famine, the benefits would be tremendous.

Canadian highways, Mr. Willis warned, would continue to be greatly inferior to those of the United States until we can induce our government to accept the ideas, not only of federal aid, but also of the earmarking of provincial revenues from road users for the building of highways.

Profit Sharing as an Incentive

J. B. Carswell, O.B.E., M.E.I.C., of Vancouver, a past President of the Association and now Chairman of Kitimat Constructors, was the speaker at the closing luncheon on Wednesday. He denounced "stale" ideas in building design and in obsolescent building materials. He also advocated a thorough, though gradual advance, in the matter of applying labour incentives.

Recalling the tough conditions with which the labourers of thirty years ago had to contend, he traced the evolution towards today's restricted hours, higher wage rates, recognition of the need for cost-of-living, sickness and accident benefits, pensions, etc., that have been thrust upon employers, he pointed out that all sensible men accepted these advances today as fundamentally sound. To attempt to project that picture 30 years into the future would be useless. But, he warned, the process will continue, and unless guided by the best brains it could turn into an industrial revolution threatening the whole structure of our capitalist system.

While it was impossible to eliminate greed and selfishness entirely, there was one road that should be studied, namely that of pooling the greed and selfishness of management and labour. Emphasizing that radical steps must be taken to eliminate this unnecessary wall between employer and employees, he advocated allocation of shares in the business to all manpower, from president to floor sweeper, so that each in proportion to the value of his effort would share in the profits. Though hedged with many problems, he believed these were not insuperable.

Statement of Policy

Following discussions by the membership of draft resolutions presented by the Management Committee for their consideration, resolutions adopted included the following:

1. Fullest co-operation among management, labour and government towards reducing costs through increased productivity.
2. All possible action to accelerate the flow of construction materials.
3. Fullest co-operation with National Defence authorities.
4. Establishment of a Federal Provincial Highways Commission to co-ordinate financing, long term planning and construction of highways to develop resources and tourist trade.
5. Replacement of level crossings to eliminate traffic hazards.
6. Reduction of the existing backlog of roads as quickly as possible.
7. An annual housing program of from 100,000 to 125,000 dwelling units as a minimum national target for 1952.
8. All necessary steps to enable an early start on the Seaway, and engagement of Canadian contractors only if the project is carried out as a purely national undertaking.
9. Amendment to labour relations legislation, to require secret ballots on strike votes under public official supervision.
10. Relief to contractors from penalization by the imposition of double workmen's compensation on workers outside of their home province.
11. Repeal of tariff item 180 (e) and substitution of a tariff on engineers and architects plans, etc.
12. Quotations on basis of firm prices for one year or duration of the work, whichever is the lesser.
13. War risk insurance by the Federal Government on real and personal property.
14. Study of European and American "payment by results" plans for construction workers, and determination of their effects on productivity, costs and incomes.
15. An orderly program of selective immigration on an equal or larger scale than for 1951, with due emphasis on bringing skilled construction men from Britain and Western Europe.

Correspondence

Mr. Editor: Winnipeg, Man.

In the design of reinforced concrete beams and columns there appears to be too little consideration generally given to problems encountered in building. In most concrete commercial buildings, the cost of labour and material for forms exceeds the cost of the concrete, therefore, if the greatest possible economy is to be obtained, the forming details should be considered in the design of the concrete sections.

In many cases the design of beam and column sections could be made to conform to dressed lumber sizes. In a beam and girder floor system the beam and column widths are usually 8″, 10″, 12″, 14″, etc. Since dressed lumber sizes are 7⅝″, 9½″, 11½″, etc., 2″ material must be ripped to obtain beam bottoms or column sides for these sizes. This leads to waste of lumber and increased labour cost.

The usual procedure in the design of beams is to establish the width of the beam — the approximate width is usually governed by past experience of the designer or by conditions pertaining to the structure — and then calculate the depth required. Using this method, it seems reasonable that the beam widths could be of convenient sizes for forming without inconveniencing the designer or affecting the structural requirements of the beam.

These arguments would also apply to the design of concrete columns. In general, they would apply mainly to interior beams and columns, because the sizes of beams and columns in exterior walls are usually governed by the wall thickness.

One may argue that a contractor should make up beam bottoms to the conventional sizes and re-use them on different jobs. This is satisfactory occasionally where jobs are fairly close together, but transportation cost becomes high where jobs are widely separated, and forming requirements vary from one building to another, making this system frequently impractical. The use of forming lumber for construction is sometimes permissible, stock sizes are much more useable in this regard than are odd sizes.

The preceding discussion does not refer to beam side forms, as they are usually made of 1″ stock which generally comes in random widths and which is more economical to rip to any required size than 2″ stock; the resulting odd widths can generally be re-used in the building as grounds or blocking.

The following table shows the widths readily obtained from dressed lumber sizes without ripping the lumber.

Nominal Width, in.	Actual Width, in.	Difference, in.
4	3⅝	⅜
6	5½	½
8	7½	½
10	9½	½
6+ 6=12	11¼	¾
6+ 8=14	13⅛	⅞
8+ 8=16	15	1
8+10=18	17	1
10+10=20	19	1

University courses and text books on reinforced concrete might well deal briefly with forming details, so that the designer should have a better understanding of the problems confronting the builder.

KENNETH S. SMITH, S.E.I.C.,
Engineer, Peter Leitch Const., Ltd.
Winnipeg, Manitoba.

News of Other Societies

Plans for the Third Industrial Engineering Conference have been announced by the Montreal Chapter of the **Society for the Advancement of Management,** to take place at the Mount Royal Hotel, Montreal, on March 28th.

The Montreal Chapter is the only unit of the Society in Canada, and has been active for some ten years.

This year's officers include the president, J. Gordon Campbell, C.A., Canadian Ingersoll-Rand Company Limited; vice-president, George W. Campbell, Continental Can Company; secretary, William R. Borland, Imperial Tobacco Company of Canada Limited; treasurer, J. J. Macdonell, C.A., Price Waterhouse & Company; and national director, John M. Keith, Imperial Tobacco Company of Canada Limited.

The ninth Canadian regional conference of the **Illuminating Engineering Society** will be held at the General Brock Hotel, Niagara Falls, Ontario, April 30, May 1 and May 2.

Mr. G. F. Mudgett, Canadian Westinghouse Company Limited, and I.E.S. convention chairman, has just released some details of the program planned for the delegates.

The fourth international lighting exposition is announced by the **National Electrical Manufacturer's Association,** to take place at the Cleveland Auditorium May 6 to 9, 1952.

The seventh annual technical session of the Reinforced Plastics Division of the **Society of the Plastics Industry, Inc.,** (67 West 44th Street, New York 18) is announced. It will take place at the Edgewater Beach Hotel, Chicago, Ill., April 9, 10, 11, 1952.

The **Institution of Electrical Engineers** (Savoy Place, London W.C. 2, England) has available details of the program of the Television Convention, 1952, which is being arranged by the Committee of the I.E.E. Radio Section, for April 28 to May 3, 1952, to discuss "The British Contribution to Television."

Tuesday, May 13, 1952, is the date that has been announced for the symposium on "instrumental methods of analysis in the non-ferrous industry". The meeting will be held at the Society of Western Engineers Building, 84 East Randolph Street, Chicago, Illinois.

The **American Association of Spectrographers,** Chicago Chapter, advises that information can be obtained from Robert Raisig, chairman of the Symposium Committee, c/o Apex Smelting Co., 2537 W. Taylor St., Chicago 12, Ill.

Elections and Transfers

At the meeting of Council held at Headquarters on Wednesday, February 20th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

L. T. Baird, *Sault Ste. Marie.*
G. Barnholden, *Calgary.*
G. H. Blumenauer, *Toronto.*
U. O. Cunard, *Montreal.*
A. Ferguson, *Montreal.*
D. D. Fraser, *Kingston.*
R. M. French, *St. John's.*
H. M. G. Garden, *Ottawa.*
V. A. Harrison, *Niagara Falls.*
H. A. Hencher, *Montreal.*
A. D. Hodgson, *Toronto.*
A. W. Johnstone, *Montreal.*
R. H. Kervin, *Sault Ste. Marie.*
R. E. Kozlowski, *Granby.*
J. L. L'Allier, *Montreal.*
M. B. M. Lawson, *Vancouver.*
J. F. MacMaster, *Borden.*
S. Rachfal, *Toronto.*
T. A. Rourke, *Lime Ridge.*
A. Steinbergs, *Corner Brook.*
E. O. Tigert, *Copper Cliff.*
M. S. Troicki, *Montreal.*
A. L. van den Brandeler, *Vancouver.*

Juniors:

J. H. Amblard, *Montreal.*
G. H. Curtis, *Montreal.*
T. T. Dobie, *Trail.*
M. J. Kenn, *Toronto.*
R. E. Miner, *Sydney.*
E. F. O'Keefe, *Kenogami.*
N. Smith, *Montreal.*
A. E. Strang, *Andover.*
M. A. Thomson, *Kamloops.*
R. H. Wittaker, *Hamilton.*
C. F. Williams, *Toronto.*
J. B. Young, *Toronto.*

Affiliate:

A. Walters, *Winnipeg.*

Transferred from the class of Junior to that of Member:

G. M. Armstrong, *Ottawa.*
N. R. Bays, *Edmonton.*
W. J. Bratina, *Toronto.*
R. S. Brown, *Montreal.*
J. B. Chambers, *Toronto.*
G. T. Christie, *Winnipeg.*
W. R. Ford, *Montreal.*
R. E. Grant, *Moose Jaw.*
D. L. B. Hamlin, *York Mills.*
R. A. Jeske, *Winnipeg.*
D. C. McCarter, *Nanaimo.*
A. Madryga, *Toronto.*
A. F. Mosher, *Sarnia.*
D. R. Sanderson, *Toronto.*
I. C. Scarlett, *Quebec.*
W. E. Ohrner, *Ajax.*

Transferred from the class of Student to that of Member:

W. N. Dutton, *Winnipeg.*

The following Students were admitted:

McGill University

J. D. V. Adams	A. C. Humann
S. M. Ayoung-Chee	P. Issenman
H. W. Barnes	T. T. Kiernan
K. A. Barwick	G. A. Laurin
E. S. Bell	H. C. Leitch
Carl Berwanger	G. F. Lorenson
H. W. Bishop	G. J. MacHutchin
L. P. Blanchard	J. L. Y. Marquis
J. H. Brodeur	W. L. Martel
C. F. Caswell	P. R. Moffatt
G. B. Champagne	J. A. Murray
G. A. M. Cockfield	T. P. W. Newton
W. J. Cosgrove	J. J. O'Shaughnessy
H. Cuevas	S. Pandelidis
E. J. Cusack	B. R. Pinder
R. F. Duston	R. H. Polischuk
I. Ellenbogen	V. Rochon
G. T. Fitzgerald	D. F. Russell
R. A. Flavell	J. M. Scholes
W. D. Gaherty	P. Shpakowsky
L. Germain	L. Slaven
C. Goldman	N. Steinmetz
J. Gravelsins	R. J. S. Tardif
P. A. Graydon	A. R. Teany
J. F. Haberl	J. Vilagos
D. R. Hodgson	J. B. Wickes
G. L. Hopkins	

University of New Brunswick

R. Battersby	G. M. Locke
E. J. W. Bliss	W. A. Macdonald
R. B. Brenan	W. L. McNamara
E. D. Christian	A. H. Neill
R. Elmer	R. D. Neill
W. J. Ford	P. R. Richards
R. J. Fraser	N. B. Tennant
W. M. Halsall	S. N. Teed
A. T. Hansen	J. W. Thompson
J. Y. Glass	C. R. Whalen
G. S. Laing	

Nova Scotia Technical College

A. L. Bates	I. C. MacLeod
L. J. Breneol	D. W. Perry
R. C. Gillespie	D. L. Phillips
K. N. Kent	E. A. MacDonald
D. G. Logan	F. R. MacKenzie

K. G. Putnam C. D. Rogers
G. C. Raymond J. T. Ward

University of British Columbia

N. Bestwick G. L. B. Nelms
T. G. Bird J. U. Sunell
R. W. Eddy R. Thompson
J. E. Herman

University of Alberta

D. N. Birenbaum S. A. Herzog
D. G. Dawson M. G. Neumeister
E. S. Eichmann

University of Manitoba

C. C. Robinson C. T. Wawrysbyn

University of Toronto

G. L. Mollenhauer H. A. Shenker

University of Saskatchewan

J. M. McCaig

Queen's University

R. K. MacGregor

Acadia University

S. R. Giffin

Mt. Allison University

R. F. White

University of Detroit

B. H. Chick

Montreal (through C.P.E.Q.)

P. A. Pietracoup

Applications Through Associations

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

ALBERTA

Members:

S. N. Carre.
J. C. Sproule.
K. D. Taylor.

Students:

L. G. Conn.
D. N. Thorogood.

Junior to Member:

R. G. Humphries.
G. A. Kotzer.
L. W. Nelson.
J. R. Ogilvie.
J. R. Rutberg.
A. R. Underhill.

SASKATCHEWAN

Members:

W. D. Neeland.
H. F. Morrow.

Junior:

J. E. Haack.

Students:

E. W. G. Bodrug.
L. V. Johnson.
W. C. Klassen.

Junior to Member:

K. W. Allcock.
R. F. Comstock.
E. K. Dokken.
S. A. Humeny.
J. L. Jasper.
H. C. Korven.
D. K. Partington.
D. I. Peterson.
G. C. Price.
L. O. Thomson.

Student to Junior:

A. A. Grindlay.

NOVA SCOTIA

Member:

N. S. Morrison.

Junior to Member:

D. E. Sawyer.
K. M. G. Tambon.
N. D. Weiner.

Personals

News of the Personal Activities of Members of the Institute

Dr. C. J. Mackenzie, M.E.I.C., president of the National Research Council at Ottawa, and a past-president of the Institute, has been appointed to take charge of the new Crown Company "Atomic Energy of Canada Limited" at Chalk River. The formation of the Government's new company and Dr. Mackenzie's appointment are a year ahead of original plans for the major reason that "prospects for early and useful industrial application of atomic energy have become more promising".

Dr. Mackenzie will relinquish his position as head of the National Research Council on April 1st, after 12 years service. He was appointed to the advisory council of the N.R.C. in 1935 and became acting president when General MacNaughton was given charge of the Canadian Active Service Force, Overseas. He assumed the presidency of the Council in 1944.

In recognition of his distinguished contributions to engineering and science, Dr. Mackenzie has been honoured by the Universities of Dalhousie, Queen's, Western Ontario, Algiers, Saskatchewan, McGill, Laval, Cambridge, British Columbia, Princeton, Toronto, and Nova Scotia Technical College. He has also held many public appointments in the City of Saskatoon.

Dr. Mackenzie was born in St. Stephen, New Brunswick; he joined the Institute as a Junior in 1911, transferred to Associate Member in 1914, to Member in 1920; and was President in 1941. In 1943 he was awarded the Sir John Kennedy Medal by the Institute.

F. L. Lawton, M.E.I.C., head of the Power Department of Aluminium Laboratories Limited, has been elected to serve as chairman of the Montreal Branch of the Institute.

Mr. Lawton was appointed head of the Power Department in 1948. He is well known in North American engineering circles, having been closely associated with the wartime expansion of power and other plant facilities of the Aluminium Company. He is a former Canadian vice-president of the American Institute of Electrical Engineers and has taken a leading part in Canadian engineering activities in the hydro-electric power field.

He graduated in electrical engineering from the University of Toronto in 1923 and spent two years with the General Electric Company at Schnectady in New York. In 1925 he was engaged as assistant to the electrical engineer of the Quebec Development Company and the Duke-Price Power Company. From 1927 to 1930 he was assistant to the superintendent of operation; in 1930 he became electrical engineer with the Duke-Price Power Company Limited (Saguenay Power Company Limited) and in 1938 was promoted to chief engineer of the Saguenay Power Company Limited at Arvida, Que. Later he became assistant chief engineer with the Aluminum Company of Canada Limited before being appointed head of the Power Department of the Aluminium Laboratories Limited.

F. D. Greenwood, M.E.I.C., of the Chromium Mining and Smelting Corporation Limited at Sault Ste. Marie, Ontario, has been elected to serve as chairman of the Sault Ste. Marie Branch of the Institute.

Mr. Greenwood was secretary-treasurer for the Branch in 1948.

He has been with the Chromium Mining and Smelting Corporation Limited since 1943; previously he worked as a design draughtsman with Hollinger Consolidated Gold Mines, with the Vipond Consolidated Gold Mines and with Ford Motor of Canada.

He graduated from Queen's University in 1931 in mechanical engineering.

L. G. McLaren, M.E.I.C., assistant district engineer of the Department of Public Works at Rimouski, Que., is the provisional chairman of the Lower St. Lawrence Branch of the Institute.

Mr. McLaren joined the Department of Public Works in 1944 as senior assistant engineer, becoming acting district engineer later in the same year and was appointed assistant district engineer in 1947.

He graduated in civil engineering from McGill University in 1924.

B. T. Yates, M.E.I.C., president and manager of H. Yates and Company Limited, has been elected to serve as chairman of the Cornwall Branch of the Institute.

Mr. Yates has had varied experience in chemical engineering with British Chemicals Limited at Trenton; construction engineering with Canadian Ex-

plosives Limited at Nobel; and as consulting engineer in partnership with the late Mr. W. L. Mackenzie in Toronto.

His activities have included directorships of the St. Lawrence Sanatorium, Cornwallis Hotel and the Cornwall Golf Club; also service as alderman of the city of Cornwall; presidency of the Cornwall Kiwanis Club and the Cornwall Development Company; and vice chairmanship of the town planning committee of the city of Cornwall, Ont.

He graduated in civil engineering from Queen's University in 1917, and he is a member of the Chemical Institute of Canada.

W. K. Sharpe, M.E.I.C., director of the Division of Sanitary Engineering at the Department of Health and Welfare at Charlottetown, P.E.I., is the provisional chairman of the Prince Edward Island Branch of the Institute.

Mr. Sharpe joined the Department of Health and Welfare in 1945 after graduating with a B.A.Sc. degree in civil engineering from the University of Toronto earlier that year.

H. R. Hatfield, M.E.I.C., president and superintendent of the Interior Contracting Company Limited at Penticton, B.C., has been elected to serve as chairman of the Central British Columbia Branch of the Institute.

Mr. Hatfield has held this position with the company since 1930. During World War II, he spent a year in the Works and Buildings branch of the R.C.A.F., and from 1941 to 1945, he acted as service and works engineer in the R.C.E., at Pettawawa, Barriefield and Chilliwack, attaining the rank of captain.

He graduated from the University of British Columbia in 1928.

G. M. Dick, M.E.I.C., manager of engineering and purchasing of Canadian Ingersoll-Rand Company Limited, at Sherbrooke, Que., has been elected to serve as chairman of the Eastern Townships Branch of the Institute.

Born in Stirling, Scotland, Mr. Dick came to Canada in 1913 and in 1915 he joined the Canadian Ingersoll-Rand Company as an apprentice pattern maker. He was rapidly promoted to tool draughtsman and chief tool designer. During the First Great War, his efforts were devoted to the design of shell manufacturing machinery for use in connection with large contracts for shells of various calibres which were undertaken by the Canadian Ingersoll-Rand Company. In the fall of 1919, he left the Company temporarily to attend Bishop's College, Lennoxville and McGill University. While at McGill he won the Babcock Wilcox and the Douglas Scholarships for Third and Fourth years, and the Pulp and Paper Association, the Engineering Institute and the Crosby prizes for summer essays, also the British Association Medal upon graduation as a Bachelor of Science in mechanical engineering in 1924. During the summer periods he was employed by the engineering departments of the Brompton Pulp and Paper Company, Babcock Wilcox and Goldie McCulloch and Canadian Ingersoll-Rand Co. In 1924, Mr. Dick returned to Sherbrooke as a design draughtsman and designing engineer on mine hoists and hauling machinery serving as chief hoist designing engineer from 1937 to 1941. During this period he travelled extensively gaining wide experience in the design and construction of hoisting machinery and its application in Canadian mines and collieries.

In 1940 he was also appointed chief engineer of Sherbrooke Pneumatic Tool Company, the shell making subsidiary of the Canadian Ingersoll-Rand Company, in which position he had complete responsibility for the design of machinery for making 4.5 and 5.5 howitzer shells. In 1941, he was appointed manager of No. 2 Manufacturing Division with responsibility for shop management, production planning and other duties related to the manufacture of air compressors, mine hoists, condensers, marine engines and special products for the Armed Forces. Later he was appointed technical assistant to the works manager at Sherbrooke and remained in this capacity until his appointment as manager of engineering.

A. S. Musgrave, M.E.I.C., municipal engineer at Oak Bay, B.C., has been elected to serve as chairman of the Vancouver Island Branch of the Institute.

Born at Cork, Ireland, he was educated at Trinity College, Dublin, where he graduated with the degrees of B.A. and B.C.E. He came to Canada in 1913 and was articled to a British Columbia land surveyor until 1914 when he enlisted for military service. He served with the Canadian Engineers from 1914 to 1919 and later as captain with the Royal Engineers. He was awarded an M.B.E. and mentioned in dispatches. From 1919 to 1935 he carried on a private practice as civil engineer and land surveyor at Victoria, B.C., in the firm of Musgrave, Whyte and Moffat. He was appointed to his present position in 1935.

He was chairman of the Victoria Branch of the Institute from 1942 to 1943 and a member of council of the Association of Professional Engineers of British Columbia.

W. H. Paterson, M.E.I.C., chief engineer of the Toronto Transportation Commission has been elected to serve as chairman of the Toronto Branch of the Institute.

Mr. Paterson has been with the Commission since 1942 when he started as an assistant manager. In 1943 he was made office engineer of the Rapid Transit Department and in 1946 was promoted to the position of engineer of rapid transit. In 1948 he became executive assistant to the assistant general manager and later was appointed as the Commission's chief engineer.

Mr. Paterson graduated from Queen's University in civil engineering in 1934, and served successively with McArthur Construction Company as foreman at Clinton, Ont., with the city of Owen Sound, Ont., as assistant city engineer, with McArthur Construction Co. as resident engineer at Alliston, Ont., with General Supply Co. of Canada Limited, Toronto, as sales engineer, and with the Tropical Oil Co., Barranca, Bermeja, Columbia, South America.

D. J. Brewer, M.E.I.C., president and manager of the Planet Construction Company Limited, at Fredericton, N.B.,

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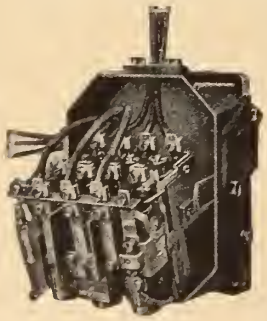

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is serving as chairman of the Fredericton Branch of the Institute.

Mr. Brewer has been with the Planet Construction Co. Ltd. since 1949; previously he was resident engineer with the Department of Public Works, Highway Division, at Fredericton.

He graduated in civil engineering from the University of New Brunswick in 1935.

D. D. C. McGeachy, M.E.I.C., president of the Canada Vulcaniser and Equipment Company Limited at London, Ontario, has been elected to serve as chairman of the London Branch of the Institute.

Mr. McGeachy was affiliated with this company as vice-president and general manager in 1948 and was appointed president in 1949. From 1946 to 1949 he was employed by William Kennedy and Son, at Owen Sound, Ont., and previously was engaged in torpedo inspection work for the British Admiralty Delegation, at Falls River, Mass., and in New York; he terminated his service with the R.C.N.V.R. in 1946 with the rank of lieutenant.

Mr. McGeachy graduated in mechanical engineering from Queen's University in 1940.

D. D. C. McGeachy, M.E.I.C.

H. C. M. Gordon, M.E.I.C., general manager of coal operations for Dominion Steel and Coal Corporation, Sydney, N.S., has been awarded the Inco Platinum Medal for his "distinguished service to the mining and metallurgical industry" and for "outstanding contributions in advancing underground mechanization in Nova Scotia". The medal was awarded at the recent annual meeting of the Canadian Institute of Mining and Metallurgy.

Mr. Gordon was born in Leven, Scotland, and attended the Royal Military College in Kingston, and McGill University. He graduated with honors in mining engineering in 1923 from McGill University and immediately joined the staff of the Dominion Coal Company. In 1946 he became general manager of coal operations for Dosco.

Robert Hewitt, M.E.I.C., is president of Hewitt Equipment Limited, the firm recently named distributor for Caterpillar Tractor Company in the Province of Quebec, with offices in Montreal and Quebec City.

Robert Hewitt, M.E.I.C.

Mr. Hewitt is associated, in the newly formed company with his brothers, C. J. Hewitt and William J. Hewitt, vice-presidents, who for many years have been partners in the building contracting business of James W. Hewitt & Sons in Toronto.

Robert Hewitt was, from 1944 until recently, vice-president and a director of George W. Crothers Limited, the present Caterpillar distributor in Ontario. From 1936 to 1944 he was a sales engineer with General Supply Company of Canada Limited, and specialized in Caterpillar products. He graduated in civil engineering from University of Toronto.

J. W. Parkin, M.E.I.C., director of the National Aeronautical Establishment at Ottawa, has been awarded the honorary fellowship of the Institute of Aeronautical Sciences.

Two honorary fellowships are awarded by the Institute of Aeronautical Science each year, one to an American and one to a foreign member selected from a membership of about 9,000. This is the first year that this distinction has been given to a Canadian citizen.

Mr. Parkin was mentioned in this section of the *Journal* in December 1951 as the recipient of the Engineering Alumni Medal of the University of Toronto Engineeriing Alumni Association.

Norman A. Eager, M.E.I.C., vice-president, general manager and a director of The Burlington Steel Company Limited at Hamilton, Ont., has recently been appointed to the Hamilton Advisory Board of the Huron and Erie Mortgage Corporation and the Canada Trust Company. Mr. Eager is also a director of the Pilot Insurance Company.

He graduated in civil engineering from McGill University in 1922 and received his Master's degree from Cornell University in 1923.

L. B. Baranowski, M.E.I.C., chief engineer of S. F. Bowser Company Limited has recently been appointed vice-president of the Company.

Mr. Baranowski graduated in mechanical engineering from the Technical University of Lwow, Poland, in 1936.

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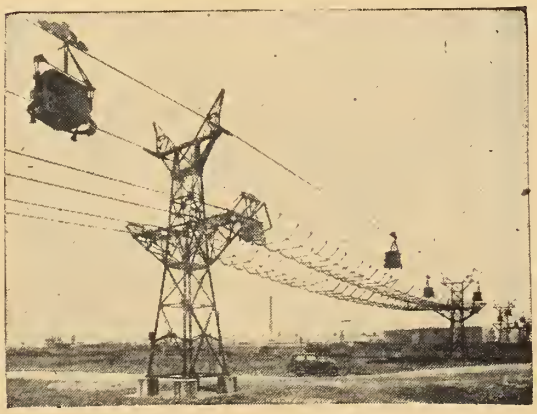

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ENROLMENT

The enrolment in the Senior School is limited to 175 boys and in the Junior School to 75 boys. For over ten years the available vacancies have been taken many months in advance and boys are entered until 1962. There are still some places available for September 1952.

SCHOLARSHIPS

Memorial Scholarships to the value of $500 a year are offered for annual competition; candidates write the regular entrance examinations at the beginning of May.

BURSARIES

Many bursaries of varying amounts are awarded annually to deserving boys. These are endowed bursaries, and those given by the Old Boys' Association, the Ladies' Guild and other friends of the School.

Further information will be gladly given on request to the Headmaster,

PHILIP KETCHUM, M.A

Trinity College School

PORT HOPE, ONTARIO

Ontario Hydro Appointments

Gordon Mitchell, M.E.I.C., has been appointed project manager for the $182,000,000 Sir Adam Beck-Niagara Generating Station at Niagara Falls, Ontario.

Born in Hamilton, Mr. Mitchell attended Hamilton Public and High Schools and graduated in civil engineering from University of Toronto in 1915. In 1916 he went overseas with the Royal Canadian Engineers, transferring to the Royal Engineers and rising to the rank of captain. He was awarded the Military Cross.

From 1920 to 1924 he was assistant superintendent, powerhouse construction, on the Sir Adam Beck-Niagara G.S. No. 1. During the next 13 years he was superintendent on a number of power developments particularly in the north country. In 1937 he rejoined the Ontario Hydro as construction engineer, generation, in charge of all basic power developments and diversions.

Mr. Mitchell is a member of the Ontario Association of Professional Engineers.

R. Harvey Self, M.E.I.C., has been promoted to construction engineer, generation, of the Ontario Hydro Electric Power Commission.

Educated in Toronto Public and High Schools, Mr. Self graduated from the University of Toronto in civil engineering in 1936. Upon graduating he worked in construction engineering with various industrial firms and contractors including Canada Packers Company Limited, Canadian Industries Limited, Canadian Kodak Company Limited, and Bennett-Pratt Limited.

In November, 1940, he joined the Construction Division of the Ontario Hydro under Gordon Mitchell and David Forgan, as an assistant works engineer on construction plant and design.

For two years during the War — 1943 to 1945, he was on loan to the Department of National Defence, Ottawa, and worked as executive assistant to the chief engineer, Works and Buildings Naval Service, and later as a special research engineer in the Directorate of Operational Research — Army.

Mr. Self is a member of the Ontario Association of Professional Engineers and became a full member of the Institute in May, 1940. He is active in the University of Toronto Engineering Alumni Association.

Gordon Mitchell, M.E.I.C.

R. Harvey Self, M.E.I.C.

A. C. Macnab, M.E.I.C., has joined the Aluminum Co. of Canada in Montreal. Previously, Mr. Macnab worked with Dominion Woolens and Worsteds Limited at Hespeler, Ontario, and earlier with Donald Ropes and Wire Cloth Limited at Hamilton, Ontario.

He graduated with a B.A.Sc. degree from the University of Toronto in 1932 and received his Master's degree in 1944.

L. R. Stratton, M.E.I.C., has been appointed chief engineer of the National Harbors Board.

Mr. Stratton has been with the Government in Ottawa since 1943 when he was named structural principal engineer with the N.H.B. Previously, he served with the board at St. John and at Montreal.

He graduated in civil engineering from the University of New Brunswick in 1930.

H. W. Johnston, M.E.I.C., has recently entered into private practice as a consultant in pulp and paper and chemical engineering in Montreal, Que. He has resigned as vice-president and director of Sutherlands Refiner Limited but will act as consultant to the Sutherland interests in Canada, the United States and foreign countries.

Mr. Johnston was for some years chief engineer with Canadian Prest Air Limited and in 1924 was in charge of the design, research and construction of a plant for the manufacture of solidified carbon dioxide by cryogenic methods.

He graduated in chemical engineering from McGill University in 1921, having taken special studies in mathematical physics, hydraulics, structural engineering and cryogenic engineering.

Shawinigan Water and Power Company Appointments

Gordon D. Hulme, M.E.I.C., has been appointed as an assistant vice-president of The Shawinigan Water and Power Company, Montreal.

Mr. Hulme graduated from McGill University in 1931 in electrical engineering, and joined the Shawinigan Company the same year. Two years later, after assignments in Trois-Rivieres, Victoriaville, Quebec City and Shawinigan Falls, he was appointed assistant engineer of the transmission line and communication division, subsequently becoming assistant to the superintendent of that division. In 1937, he joined the Company's department of industrial development, becoming its assistant manager in 1942. He was appointed head of public relations and advertising when that department was formed in 1945.

Mr. Hulme was a founder and the first president of the Canadian Public Relations Society, and has been a vice-president and director of the Public Relations Society of America.

Louis Trudel, M.E.I.C., has been appointed manager of the public relations and advertising department of The Shawinigan Water and Power Company, Montreal, succeeding Mr. Gordon D. Hulme.

Mr. Trudel attended College St. Marie and College Jean de Brebeuf in Montreal, receiving his B.A. degree from the University of Montreal in 1931 and his engineering degree at the Ecole Polytechnique in 1936. He was subsequently with the Quebec Electricity Commission, Southern Canada Power Company and Marine Industries Limited, and in 1939 became assistant general secretary of The Engineering Institute of Canada. He joined the Shawinigan Company in 1947.

He is a member of the publication committee of *The Engineering Journal.*

G. D. Hulme, M.E.I.C.

Louis Trudel, M.E.I.C.

J. J. Miller, M.E.I.C., electrical engineer and mechanical superintendent of the Niagara, St. Catharines and Toronto Railway Company has been transferred to the St. Clair Tunnel Company, Port Huron, Michigan, as electrical superintendent. He has therefore had to resign the chairmanship of the Niagara Peninsula Branch of the Institute.

Mr. Miller joined the company in 1945 after seven years service with Canadian National Railways. For C.N.R., in 1944 he worked on developing new methods of maintenance for motive power and car equipment and was appointed chief electrical supervisor of the electric traction system of the C.N.R.

G. H. Burbridge, M.E.I.C., former district engineer of the Department of Public Works of Canada at Fort William, Ont., was re-elected as chairman of the Port Arthur Planning Board, at its inaugural meeting in January.

Mr. Burbridge had been connected with the Department of Public Works since 1912. He was in charge of the Fort William-Port Arthur area, as district engineer for five years before his retirement.

Reviewing the activities of the Planning Board, Mr. Burbridge told of plans submitted covering existing and proposed arterial highways in the city; and amendments to the zoning bylaw of the city; and plans for industrial trackage in the city.

J. A. Bardsley, M.E.I.C., has been appointed chief engineer with the Howard Smith Paper Mills Limited, in Montreal.

Mr. Bardsley has been assistant to the chief engineer of the Howard Smith Paper Mills Limited since 1947. Previously he was engaged on maintenance, design and layout work with the Wayagamack Pulp and Paper Company at Three Rivers from 1922 to 1925; Consolidated Paper Corporation from 1931 to 1933; design and construction work with the Australian Paper Manufacturers from 1937 to 1945, including design, installation and operation of the Kraft Pulp Mill; and construction work on the new mill for the Wabasso Cotton Company, at Grand Mere, P.Q., in 1946.

F. Freeborn, M.E.I.C., has been promoted from Construction Commander to Construction Captain in the R.C.N., and is principal overseer in the Montreal area, stationed at Canadian Vickers Limited.

Previously, he was manager of the construction department of the Department of National Defence, Naval Service at H.M.C. Dockyard at Esquimalt, B.C. During World War II, he was a Lieutenant Commander (S.B.) in the R.C.N.V.R. as assistant supervisor of overseers Maritimes at H.M.C. Dockyard at Halifax, N.S.

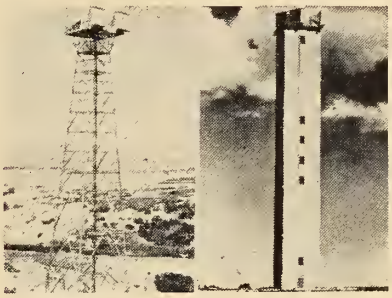
Aerial Survey

SAVED: 1 TOWER

Within the next decade 14 million Canadians will reap the benefits of speedier communications and a wealth of entertainment from a new type of telephone and TV transmission: radio relay.

In radio relay, microwaves which travel in a straight line are flashed through the air by relay towers, usually on hilltops about 30 miles apart. Each tower picks up microwave signals from its neighbour and—amplifying and focussing them like a searchlight—beams them accurately at the next tower. Hundreds of long-distance telephone calls can ride the beam at the same time.

The first telecommunications systems using radio relay in Canada are now under construction. In the planning of these, aerial survey has played an important role—as it will in the mushrooming radio relay development Canadians can expect in the immediate future.



Radio relay towers—intervisibility the key

The plotting of a radio relay system joining—say—two cities, raises this problem: To select the route between city A and city B requiring the fewest number of towers, each properly spaced and having intervisibility with its neighbours. In addition, every tower should be readily accessible and convenient to an electric power supply.

A number of surveys for the siting of radio relay towers—made by the Photographic Survey Corporation Limited—have indicated that aerial survey may "save" one tower in ten. Normally, this saving more than pays the cost of the survey.

In this type of survey a general route is first chosen, and a strip of aerial photography 5 miles wide flown along this line. From the photography and elevations obtained by PSC's Airborne Profile Recorder, topographic maps are produced at a scale of 4 inches to 1 mile with contours at 25 foot intervals, and the route finally selected is profiled on an earth's curvature graph.

This method assures the engineer he has located the minimum number of towers, with sufficient clearance between sites to guarantee unbroken transmission.

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5-52

Winnipeg Hydro Appointments

T. E. Storey, M.E.I.C., has been promoted to assistant general manager of the City of Winnipeg Hydro-Electric System.

Mr. Storey joined the staff of the City of Winnipeg Hydro-Electric System in 1929 as design engineer. From 1935 he was chief operator at Slave Falls Power Plant until 1940 when he was transferred to the Engineering Department at head office as operating engineer. In 1944 he was appointed general superintendent in charge of production and became chief engineer in 1948.

He was for a short time with the Canadian General Electric Company after his graduation from the University of Manitoba in 1928.

D. C. Bryden, M.E.I.C., has been promoted to chief engineer with the City of Winnipeg Hydro-Electric System.

Mr. Bryden was born in England and came to Canada in 1911; he was educated in Edmonton where he graduated in electrical engineering from the University of Alberta with his B.A. and B.Sc. in 1928. After two years with the Canadian Westinghouse Company in Hamilton, Ont., he joined the City of Winnipeg Hydro-Electric System in 1930 as power sales engineer. In 1940 he was appointed assistant superintendent of power plants; in 1946 he was made operating engineer and in 1948 he became general superintendent in charge of production.

R. T. Harland, M.E.I.C., has been promoted to principal engineer in charge of design of Winnipeg Hydro-Electric System.

Mr. Harland was born in Winnipeg, educated at St. John's College School and graduated from the University of Manitoba in electrical engineering in 1938 with a gold medal. After a brief period with the City of Winnipeg Hydro-Electric System he resigned in 1939 to take his Master's course at the Massachusetts Institute of Technology, graduating in 1941, whereupon he returned to the City Hydro. He served with the R.C.A.F. from 1942 to 1945; rejoining the City Hydro as operating engineer for a few months until he was appointed assistant principal engineer in charge of design in 1948.

T. E. Storey, M.E.I.C.

D. C. Bryden, M.E.I.C.

L. A. Bateman, M.E.I.C., has been promoted to general superintendent in charge of production for the City of Winnipeg Hydro-Electric System.

Born and educated in Winnipeg, Mr. Bateman graduated from the University of Manitoba in electrical engineering in 1942 and received his Master's degree in 1948. He joined the City of Winnipeg Hydro-Electric System in 1942 and has served as operating engineer since 1948.

R. A. Stewart, M.E.I.C., has been promoted to assistant principal engineer responsible for design and operation (steam division) at the City of Winnipeg Hydro-Electric System.

Born and educated in Winnipeg, Mr. Stewart graduated from the University of Manitoba in electrical engineering in 1939. After graduation he joined the City of Winnipeg Hydro-Electric System. He served with the R.C.A.F. from 1942 to 1945 and upon his return was appointed assistant design engineer (steam division).

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Appointments at T. Pringle & Son Limited

G. M. Wynn, M.E.I.C., vice-president of T. Pringle and Son Limited, has retired due to ill health.

Mr. Wynn first became associated with this firm in 1904, and in 1909 was in responsible charge of a large number of steel and concrete industrial structures, paper mills, warehouses, cotton mills, etc., and numerous dams, hydro electric developments and many other projects incident to general consulting practice.

In 1925 he was second vice-president and director, later becoming vice-president which position he held until his retirement.

E. C. Miller, M.E.I.C., has been elected vice-president of T. Pringle and Son, Limited, industrial engineers, at Montreal.

Mr. Miller has been associated with the company for many years, having served as manager of their Toronto office prior to 1934 and director, and later as managing director in Montreal since 1934

E. C. Miller, M.E.I.C.

R. G. Barbour, M.E.I.C., has been elected general manager of T. Pringle and Son, Ltd. at Montreal.

Previously, he was chief electrical and mechanical engineer. Prior to joining this firm he worked with Canadian General Electric and Aluminum Company of Canada Limited on construction and operation.

Mr. Barbour graduated in electrical engineering from the University of New Brunswick in 1924 and received his Master's degree in 1927.

R. G. Barbour, M.E.I.C.

J. E. Harris, M.E.I.C., works engineer of the Sarnia plant of Dow Chemical of Canada, Limited, has been appointed manager of the newly-formed Construction Department and will be responsible for the co-ordination and supervision of all phases of Dow's construction work in Canada.

Mr. Harris graduated in chemical engineering from the University of British Columbia in 1938 and received his M.A. degree in 1942.

J. E. Underwood, M.E.I.C. and **R. A. McLellan,** M.B.E., M.E.I.C., are now carrying on their consulting practice in Saskatoon under the name of Underwood McLellan and Associates Limited. Associates are G. M. Beaumont, M.E.I.C., B. M. Ellis, M.E.I.C., D. A. Ferguson, JR.E.I.C., W. G. McKay, M.E.I.C., and F. L. Small. M.E.I.C.

P. H. Buchan, M.E.I.C., who was district engineer, city lines, B.C. Electric Railway Company Limited, retired in January after 42 years' service and is taking up residence in Victoria, B.C.

Mr. Buchan joined the B.C. Electric Railway Company as an assistant engineer, Way Department, after graduating from the University of Toronto in 1909. He was chairman of the Vancouver Branch of the Institute in 1934.

E. T. Skelton, M.E.I.C., is employed with the City of London, Ontario. Previously, Mr. Skelton was assistant to the City Engineer of Westmount, Que., and in the Department of Public Works at Westmount.

He graduated in civil engineering from the University of New Brunswick in 1947.

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QUEBEC MONTREAL VAL D'OR

J. S. Motherwell, M.E.I.C., is working with Sandwell and Company, consulting engineers in Vancouver.

Previously, Mr. Motherwell had been with the engineering department of the Powell River Company in British Columbia, since his release from the R.C.A.F. in 1945. Before the war, he worked for the Dominion Engineering Company Limited at Montreal.

He graduated from the University of British Columbia in mechanical engineering in 1936.

C. L. Knight, M.E.I.C., is with the Works and Hydraulics Department at Scarborough, Tobago, B.W.I.

Previously, Mr. Knight was Colonial Engineer with the Public Works Department at Castries, St. Lucia, B.W.I., and earlier with the Public Works Department at St. Georges Grenada, B.W.I.

He graduated in civil engineering from McGill University in 1945.

H. I. Stevenson, M.E.I.C., holds the position of townsite foreman for the town of Powell River in British Columbia. Previously, Mr. Stevenson was with the Manitoba Paper Company Limited at Pine Falls. He graduated in civil engineering from the University of Manitoba in 1938.

N. E. Greenaway, M.E.I.C., is president of Asphalt Services Limited at Saskatoon, Saskatchewan.

Previously, he was sales engineer with Husky Oil and Refining Limited. He graduated in civil engineering with a B.A.Sc. degree from the University of British Columbia in 1947.

D. Y. Ferguson, M.E.I.C., has joined Dominion Tar and Chemical Company at Montreal, Que. Previously, he was a sales engineer with the Permutit Company Limited at Toronto, Ont.

Mr. Ferguson graduated in chemical engineering from the University of Toronto in 1940.

D. P. Herring, M.E.I.C., senior project engineer with Polymer Corporation Limited at Sarnia, Ont., has been re-elected to the Sarnia Hydro Commission and chairman of the Commission for 1952. Mr. Herring is vice-chairman of District 8, of the Ontario Municipal Electric Association and a member of the board of directors.

He graduated in mechanical engineering from the University of Saskatchewan in 1942.

D. P. Herring, M.E.I.C.

B. H. Mackenzie, M.E.I.C., has been elected to the Sarnia Hydro Commission in the recent municipal elections. Previously a senior project engineer at Imperial Oil Limited, he has been promoted to chief engineer of the Imperial Pipelines Division of the Company.

Mr. Mackenzie graduated in mechanical engineering from the University of Toronto in 1938.

Bruce H. Mackenzie, M.E.I.C.

E. J. Robertson, M.E.I.C., has joined the staff of Bepco Canada Limited as traction department engineer in the Toronto office.

Mr. Robertson graduated in electrical engineering from Manchester University in England, and has had considerable experience in Britain both with manufacturing and operating companies. He was a mechanical and electrical engineer in the Air Ministry Works Directorate during the war and was the chief electrical engineer to the Manchester Corp-

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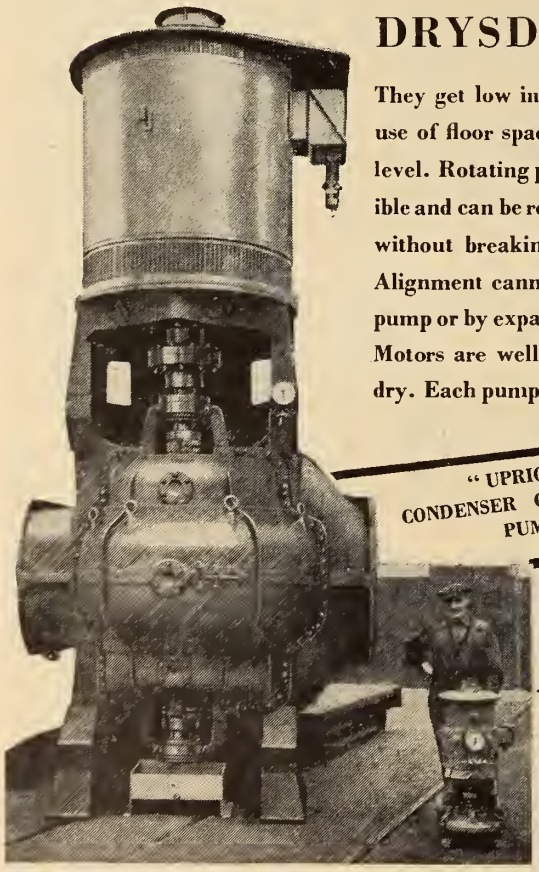

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oration Transport Department prior to coming to Canada in 1949. Since then, Mr. Robertson has been acting in an engineering capacity in the electrical department of the Toronto Transportation Commission specializing in the signal system for the Rapid Transit project.

He is an Associate Member of the Institution of Electrical Engineers, a member of the American Institute of Electrical Engineers and of the Association of Professional Engineers of Ontario.

Stirling Ross, M.E.I.C., veteran member of the B.C. Telephone Company's engineering staff who has held the position of equipment and building engineer for the past eight years, has been appointed staff engineer in charge of special projects at Vancouver, B.C.

Mr. Ross joined the B.C. Telephone Company in 1909 rising to the position of equipment engineer in 1924. He assumed the dual role of equipment and building engineer in 1944.

He is a member of the Association of Professional Engineers of British Columbia.

Stirling Ross, M.E.I.C.

R. A. Ritchie, M.E.I.C. ,has been appointed assistant resident engineer with the Dominion Tar and Chemical Company at Montreal.

Mr. Ritchie has recently been working with the Columbia Cellulose Company Limited at Prince Rupert, B.C. and with the Canadian Chemical Company at Edmonton, Alberta.

He graduated in mechanical engineering from McGill University in 1943.

H. T. Ralph, M.E.I.C., has been appointed superintendent of the new parchment division of the Kalamzoo Vegetable Parchment Company Limited at Espanola, Ont.

Mr. Ralph has been employed by the K.V.P. Company Limited since 1944, he graduated in civil engineering from Queen's University in 1934.

R. F. Brooks, JR.E.I.C., has been appointed assistant to the superintendent of the Shawinigan Falls power developments of the Shawinigan Falls Water and Power Company. Before this appointment, Mr. Brooks held the position of staff assistant in the substation division. He joined the company as a graduate in training in 1949; previously he was on survey work for the Topographical Survey Department of Mines and Resources at Ottawa.

He graduated in electrical engineering from the University of New Brunswick in 1946.

A. J. Summach, JR.E.I.C., is working for the Manitoba Power Commission at Winnipeg, Manitoba.

Mr. Summach graduated from the University of Manitoba in electrical engineering in 1950.

L. W. Locke, JR.E.I.C., has been promoted to operating engineer with the City of Winnipeg Hydro Electric System. Mr. Locke graduated from the University of Manitoba in electrical engineering in 1948 and immediately joined the City Hydro. After a period as electrical maintenance engineer he was transferred to electrical design in 1951.

W. R. K. Coulthard, JR.E.I.C.. is resident engineer with the Central Mortgage and Housing Corporation at Winnipeg.

Previously, he was employed as general construction engineer for Defence Construction Ltd., at Brandon, Manitoba.

Mr. Coulthard graduated from the University of Manitoba with a degree of B.Sc. in civil engineering in 1950.

F/L K. M. Eyolfson, JR.E.I.C., has rejoined the R.C.A.F. at North Bay, Ont., acting as an instructor in the Officer's Training Unit at the R.C.A.F. station at North Bay.

Since April of last year, Mr. Eyolfson has received courses of instruction in Prince Edward Island, Texas and Florida; previously he was with the Geological Survey at the Victoria Museum in Ottawa.

He graduated in electrical engineering from the University of Saskatchewan in 1950.

E. L. Fowler, JR.E.I.C., has taken a position as engineer in charge of the Soils Division with the Testing Laboratories

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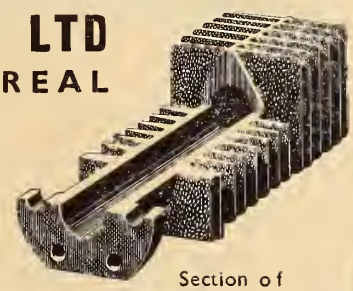

Section of Premier Diamond Economiser Tube

of the Department of Public Works in Ottawa. Previously he had worked in the Soils Laboratory at Parliament Buildings in Toronto, Ont.

He graduated with a B.A.Sc. degree in civil engineering from the University of Alberta in 1948 and received his Master's degree in 1950. He was also awarded the Association of Professional Engineers of Alberta Gold Medal in civil engineering.

C. W. Case, JR.E.I.C., is deputy city engineer for the City of Chatham, Ont.

Mr. Case was appointed assistant city engineer after his graduation from the University of Toronto in 1950.

W. E. Blake, JR.E.I.C., has been promoted to the rank of Major at the Royal Canadian School of Military Engineering at Chilliwack, British Columbia.

Previously he was a captain in the R.C.E. at H.Q. Eastern Ontario Area, at Kingston, Ont., and at Ottawa.

Major Blake graduated in civil engineering from Queen's University in 1947.

J. B. Bowron, JR.E.I.C., is working as a sales engineer for the English Electric Company of Canada, at Calgary, Alberta.

Mr. Bowron graduated in electrical engineering from the University of Alberta in 1950.

J. Hiebert, JR.E.I.C., has joined the engineering staff of A. V. Roe (Canada) Limited at Malton, Ont.

Previously he worked for the Manitoba Highways Branch and the Universal Construction Company of Winnipeg.

He graduated from the University of Manitoba in mechanical engineering in 1950.

R. J. Kostick, JR.E.I.C., is employed with Canadian Oil Refineries Limited at Sarnia, Ont. Previously he was on development work in the Technical Department of the Aluminum Company of Canada Limited, at Arvida, Que.

Mr. Kostick graduated from the University of Toronto in chemical engineering in 1950.

R. E. J. Layton, JR.E.I.C., has recently been appointed chief mechanical engineer with T. Pringle and Son Limited, and will assume responsibility for the design and supervision of mechanical building services.

Mr. Layton joined this firm in 1947 after obtaining his degree in mechanical engineering from McGill University.

R. E. J. Layton, M.E.I.C.

H. F. Atyeo, JR.E.I.C., is a resident engineer on the Richmond Hill Sewer Project, working for Proctor, Redfern and Laughlin, consulting engineers.

Mr. Atyeo graduated in civil engineering from the University of New Brunswick in 1950.

A. Assaly, JR.E.I.C., is assistant to the president of the Pulp and Paper Research Institute of Canada at Montreal.

Mr. Assaly has been a lecturer in the Department of Mechanical Engineering at McGill University since 1949, and previously worked with Canadian Comstock Company Limited at Montreal after graduating from McGill University in 1946 with an Honors degree in mechanical engineering.

V. M. Appelt, JR.E.I.C., is working for the Chief Engineer's Branch of the Department of Public Works at Edmonton.

Mr. Appelt graduated in civil engineering from the University of Alberta in 1950.

L. D. Cooper, JR.E.I.C., is a draughtsman with A. V. Roe (Canada) Limited at Malton, Ont.

Mr. Cooper graduated from the University of British Columbia in mechanical engineering in 1950.

Z. L. Czaplinski, JR.E.I.C., has joined the Monsanto Chemical Company at Ville La Salle, Que., as a design engineer.

Previously, Mr. Czaplinski was working for St. Raymond Paper Company, Limited, at Desbiens, Que.

He graduated from the McGill University in chemical engineering in 1950.

J. J. Bleau, JR.E.I.C., is engineering representative with the Dominion Oxygen Company at Montreal.

Mr. Bleau graduated in mechanical engineering from McGill University in 1950.

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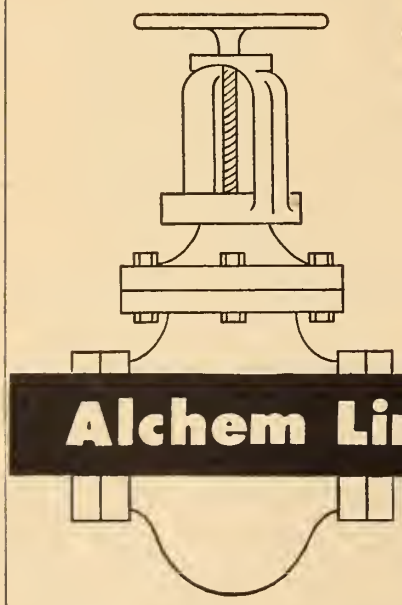

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H. L. Bertrand, Jr.E.I.C., is a mill superintendent with the Sunshine Larden Mines Limited, at Beaton, B.C.

Mr. Bertrand graduated in chemical engineering from the University of Alberta in 1950 and worked with Mill Assayer (Ore Concentrates) Highland Bell Limited, at Beaverdell, Alberta, before joining the Sunshine Larden Mines.

S. J. Cadel, Jr.E.I.C., is employed as a wiring device engineer with the Canadian General Electric Company Limited in Toronto.

Mr. Cadel graduated in electrical engineering with a B.A.Sc. degree from the University of British Columbia in 1950.

E. M. Dawson, Jr.E.I.C., is employed as an engineer in the gas turbine division of A. V. Roe (Canada) Limited, at Malton, Ont.

Previously he was an operating instructor in the service department of General Motors Diesel Limited, at London, Ont.

Mr. Dawson graduated in electrical engineering from the University of Alberta in 1950.

G. Ducharme, Jr.E.I.C., is with the Sangamo Company at Montreal. He was previously a traffic engineer with the Montreal Tramways Company.

Mr. Ducharme graduated in civil engineering with a B.A.Sc. degree from Ecole Polytechnique in 1949.

V. M. Clarkson, Jr.E.I.C., is with the Federal Civil Service Commission at Ottawa, as an examiner of professional and technical personnel.

Mr. Clarkson joined the Civil Service Commission in this capacity immediately upon his graduation in civil engineering from the University of New Brunswick in 1949.

D. M. Harris, Jr.E.I.C., is working with Wm. Kennedy and Sons Limited.

Mr. Harris graduated from the University of Toronto in 1949 and worked for a time as sales engineer with Magee and Sons Limited at Port Colborne, Ont.

W. C. Heaney, Jr.E.I.C., is an apprentice machinist with the Canadian Pacific Railway at Kenora, Ont.

Mr. Heaney graduated in mechanical engineering from the University of Manitoba in 1950.

M. E. Thompson, Jr.E.I.C., has left the inspection services of the National Defence Department at Ottawa to join the Sperry Gyroscope Company Limited at Montreal, as a field service engineer.

Mr. Thompson graduated in electrical engineering from the University of Manitoba in 1949.

R. W. McBride, Jr.E.I.C., is employed as junior engineer with the Columbia Cellulose Company Limited at Watson Island.

Mr. McBride graduated in mechanical engineering from the University of British Columbia in 1950.

W. D. Matheson, Jr.E.I.C., holds the position of maintenance superintendent with Restigouche Company Limited at Campbellton, N.B.

Mr. Matheson joined this Company as assistant to the plant engineer in 1950 after graduating from the University of New Brunswick in civil engineering.

L. Morgante, Jr.E.I.C., is a mechanical engineer with E. Long Limited at Orillia, Ont. He graduated from Queen's University in mechanical engineering in 1950.

O. C. Norris-Elye, Jr.E.I.C., is a sub-lieutenant in the Royal Canadian Navy on H.M.S. "Stadacona" at Halifax, Nova Scotia.

Previously he was working as design engineer in the gas turbine division of A. V. Roe (Canada) Limited at Malton, Ont.

Mr. Norris-Elye graduated in electrical engineering from the University of Manitoba in 1950.

T. A. Sissons, Jr.E.I.C., has left the Canadian General Electric Company Limited at Calgary to join the Medicine Hat Brick and Tile Company Limited, at Medicine Hat, Alberta.

Mr. Sissons had been in the service division with C.G.E. Co. Ltd., since 1947, in Vancouver, B.C., and at Calgary, Alberta.

He graduated in electrical engineering from the University of Alberta in 1946.

T. H. Lackie, Jr.E.I.C., is employed as a Public Health Engineer with the Province of Manitoba. Formerly Mr. Lackie was employed with the firm of Underwood and McLellan, consulting engineers at Saskatoon, Saskatchewan,

Mr. Lackie graduated from the University of Manitoba in civil engineering in 1950 and completed a post graduate course in public health engineering at the University of Toronto before joining Underwood and McLellan.

J. N. Thompson, Jr.E.I.C., has joined the Abitibi Power and Paper Company at Toronto, Ont., as a design engineer in the consulting office. He had been working with C. H. Hoople Company at St. Catharines, Ont.

Mr. Thompson graduated in mechanical engineering from the Nova Scotia Technical College in 1950.

F. L. Ward, Jr.E.I.C., has joined the Clifford Manufacturing Company at Waltham in Massachusetts, U.S.A.

Previously he was with the engineering Department of the Trans-Canada Airline at Dorval, Que., and at Winnipeg, Manitoba.

Mr. Ward graduated in electrical engineering from the University of New Brunswick in 1945.

F/O L. A. Wade, Jr.E.I.C., is completing a telecommunication course with the Radio School of the R.C.A.F. station at Clinton, Ont.

He graduated in electrical engineering from the University of New Brunswick in 1950.

G. Dion, Jr.E.I.C., is field engineer for Concrete Repairs and Waterproofing Company Limited at Quebec.

Previously he had been with Alain Incorporated at St. Emile de Lorette, Que.

He graduated in civil engineering from Ecole Polytechnique in 1950.

J. C. Claire Gain, Jr.E.I.C., is employed with the Brown Corporation at La Tuque, Que.

Previously he was a control chemist with the Abitibi Power and Paper Company Limited, at Sturgeon Falls, Ont.

He graduated in chemical engineering from the University of Toronto in 1946.

A. P. Cunningham, S.E.I.C., is working as a production control engineer with Canadian Vickers Limited at Montreal, Que.

Mr. Cunningham graduated in mechanical engineering from the University of Toronto in 1951.

K. C. Lyons, S.E.I.C., (McGill University, electrical engineering, 1951) is on a test course with the Canadian General Electric Company Limited at Toronto, Ont.

G. D. Robinson, S.E.I.C. (University of British Columbia, mechanical engineering, 1951) is working in the Aircraft Design Division of A. V. Roe (Canada) Limited.

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V. E. Campbell, S.E.I.C., has joined the Canadian General Electric Company Limited at Halifax, Nova Scotia.

Previously he was working as a graduate engineer in training with Canadian Westinghouse in Hamilton, Ont.

Mr. Campbell graduated in mechanical engineering from the University of Saskatchewan in 1951.

A. E. Benn, S.E.I.C., has joined Curtin-MacNamara - Manning - Morrison and Knudsen as resident engineer at Mont Joli, Que.

Previously he was working for Wallace A. Mackey in Weston, Ont. He had also worked for a year on the Highway Location Survey with H. W. Nunn after his graduation from Queen's University in civil engineering in 1948.

R. F. MacMilan S.E.I.C. (University of Manitoba, civil engineering, 1950) is working as an instrumentman with the Fraser-Brace Engineering Company Limited, at Isle Maligne, Que.

I. D. Macorquodale, S.E.I.C., is a manufacturing methods engineer with the Northern Electric Company in Montreal.

Mr. Macorquodale graduated in mechanical engineering from McGill University in 1948.

J. P. Monarque, S.E.I.C. (McGill University, chemical engineering, 1951) is working with The Distillers Corporation Limited in Montreal, Que.

Visitors to Headquarters

R. E. Tweeddale, M.E.I.C., Fredericton, N.B., January 10, 1952.

A. C. Macnab, M.E.I.C., Hespeler, Ont., January 10, 1952.

R. M. Richardson, M.E.I.C., Saint John, N.B., January 16, 1952.

W. R. Stickney, M.E.I.C., Toronto, January 17, 1952.

V. A. McKillop, M.E.I.C., London, Ont., January 19, 1952.

J. S. Busay, Quebec City, January 19, 1952.

R. A. Ritchie, M.E.I.C., Edmonton, Alta., January 24, 1952.

W. W. Anjoy, Saint John, N.B., January 24, 1952

J. McMillan, M.E.I.C., Calgary, January 25, 1952.

J. Taylor, M.E.I.C., Ottawa, Ont., February 2, 1952.

J. F. Crowley, M.E.I.C., Dundas, Ont., February 6, 1952

W. Thornber, M.E.I.C., Vancouver, B.C., February 11, 1952.

C. R. Stern, Victoria, B.C., February 18, 1952.

A. Paskevicivs, M.E.I.C., Ottawa, Ont., February 19, 1952.

H. A. Willams, Dulwich, England, February 21, 1952.

A. C. Northover, M.E.I.C., Leamington, Ont., February 27, 1952.

H. R. Sills, M.E.I.C., Peterborough, Ont., February 28, 1952.

Obituaries

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

J. A. Pounder, M.E.I.C., head of the Administrative Division of the Public Projects Branch of the Department of Resources and Development at Ottawa, died very suddenly on January 7th, 1952.

Mr. Pounder was born in the County of Renfrew, Ont. He graduated with a B.A. Honors degree in mathematics and physics from the University of Toronto in 1912. In the field seasons of 1913 to 1915, and in 1919, he was in charge as assistant of parties of the International Boundary Commission working on triangulation, baseline work and precise traverses, supervising parties and making stadia traverses and topographical maps.

In 1920 he was Canadian attaché with the U.S. Boundary Survey Party on the Unuk River, Alaska, and worked in a similar capacity on the St. Croix River in 1921. Later he was chief of parties making a topographical map of a portion of Campobello Island, and survey of the S.W. Branch of the St. John River for the delineation of the International Boundary in that stream, also a topographical map of St. Andrews, N.B., and its vicinity.

During the winters of 1919 to 1922 he was engaged in the adjustment of precise and other traverses to fit control Geodetic Positions. At this time he wrote an historical sketch of the International Boundary from Passamaquody Bay to the St. Lawrence River from the earliest times and a report on former surveys of this Boundary.

D. L. Stewart, M.E.I.C., staff engineer with the Bell Telephone Company's general plant department, died suddenly on January 16th, 1952.

Mr. Stewart was born at Dunvegan, Ontario, in 1894 and at the time of his death resided at Baie d'Urfe, Que. After graduating in mechanical engineering from McGill University in 1927, he joined the Bell Telephone Company's general engineering department where he undertook special studies on utilization of creosoted Canadian woods, standardization of outside plant materials and tools and supervision of the inspection department.

In 1936 he was transferred to the general plant department, becoming station maintenance supervisor which position he held at the time of his death.

Mr. Stewart joined the Institute as a Student in 1922, became an Associate Member in 1927 and Member in 1940.

He was a life member of Maxville Lodge A.F. and A.M. No. 418, and a member of the Glengarry Chapter R.A.M.

W. A. Duff, M.E.I.C., retired engineer of bridges and standards with the Canadian National Railways died at his home in Montreal on January 21, 1951.

Mr. Duff retired from the C.N.R. in 1942 after a professional career of 41 years, 35 of which were in railway services and 4 years with bridge construction companies in the United States and Canada.

Born in Moncton, New Brunswick, in 1877, he graduated in applied science from the University of Toronto in 1901 and took his first position as draughtsman and engineer with the Vancouver, Victoria and Eastern Railway in the Kettle Valley, B.C., and a year later he came East to join the Grand Trunk at Hamilton.

For 4 years following, he was associated with bridge companies and in 1907 he became chief bridge draughtsman for the National Transcontinental Railway at Ottawa. In 1913 he was engineer for bridges with the Canadian Government Railways at Moncton, becoming assistant chief engineer in 1916.

In 1920, he was transferred to the C.N.R. as engineer of standards, his responsibilities becoming enlarged as engineer of bridges and roadway.

Mr. Duff joined the Institute as a Student in 1900, became an Associate Member in 1905 and Member in 1919; he attained his life membership in 1947.

T. W. Harvie, M.E.I.C., retired general manager of the Montreal Harbour Commission, died at his home in Westmount, P.Q., on February 7th after a long illness.

Mr. Harvie was born in Lanarkshire, Scotland, in 1877 and was educated at the Glasgow and West of Scotland Technical College. In 1894 he was apprenticed to Messrs. Kyle, Dennison and Frew, Civil Engineers, of Glasgow and later became assistant engineer with that firm. In 1900 he joined the staff of the Caledonian Railway Co. as assistant resident engineer, and in 1902 entered the service of the Clyde Navigation Trust as assistant engineer and later became resident engineer for the Trust during the construction of the Merklands docks. In 1907 he joined the contracting firm of Robert McAlpine and Sons and was agent and chief engineer on the construction of the Yorkhill basins and quays.

Mr. Harvie came to Canada in 1910 and obtained a position with the Montreal Harbour Commissioners as resident engineer on the construction of the Victoria Pier, shore wharves and other installations. In 1913 he was appointed assistant chief engineer, and became chief engineer in 1922. In 1924 he was appointed general manager and retained this position until his retirement because of ill health in 1935. As well as directing the operations of the Port of Montreal during this period, he held the position of Chairman of the Advisory Board of Engineers during the construction of the Montreal Harbour Bridge from 1925 to 1930.

He was a member of the Corporation of Professional Engineers of the Province of Quebec, a member of the American Association of Port Authorities and a member of the Institution of Civil Engineers (London).

Mr. Harvie joined the Institute as an Associate Member in 1911, became a member in 1923, and attained his life membership in 1947.

Employment Service

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

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

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

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER, preferably a recent graduate required by a well established Toronto manufacturer for laboratory work on production lines. Apply to File No. 4179-V.

CHEMIST TO TAKE CHARGE of laboratory in Montreal plant manufacturing lastex yarns. Would involve testing and analysis of products and some development work. Some experience desirable but not essential. Apply to File No. 4192-V.

CHEMICAL ENGINEER, recent graduate preferred, with or without post graduate work. The position is that of chemical process design involving hydrocarbon distillation and heat exchange. This is a good opportunity for a young engineer to develop his theoretical and practical knowledge in one of the most advanced applications of thermodynamics. Salary according to qualifications. Location Montreal. Send complete resume of education, experience if any, and recent photo to file No. 4197-V.

CIVIL

CIVIL ENGINEER, recent graduate required for city engineer's office in Ontario. Work involved is concerned with making surveys, layouts, inspection and control of construction of streets, and sewers, and miscellaneous municipal construction. Apply to File No. 4174-V.

CIVIL ENGINEER with from 2 to 4 years diversified experience (office and field) preferably bilingual and experience in municipal work. Location Montreal and free to travel. Salary open. Apply to File No. 4182-V.

ELECTRICAL

ELECTRICAL DRAUGHTSMAN required by consulting firm located in Toronto fully experienced in building construction, lighting and power layout. Apply to File No. 4173-V.

ELECTRICAL ENGINEER required for design office of Toronto manufacturer of communication and power equipment. Salary open. Sales office in Montreal. Apply to File No. 4186-V.

ELECRICAL ENGINEER required by Montreal firm specializing in manufacture, sale and installation of sound equipment, including public address, intercommunication, telephone and specialized communications apparatus. Duties include design and supervision. Salary approximately $3800.00. Apply to File No. 4191-V.

MECHANICAL

TWO MECHANICAL ENGINEERS, recent graduates required for initial training in the valve and fitting department of organization in Montreal to be absorbed eventually in sales or other branches. Apply to File No. 4170-V.

SALES ENGINEER, preferably mechanical for organization in Montreal handling heavy equipment. Location Eastern Canada. Salary open. Age 28 to 35 preferably married. Apply to File No. 4171-V.

MECHANICAL ENGINEER required by consulting firm located in Toronto. Graduate with experience in all types of heating equipment. Apply to File No. 4173-V.

MECHANICAL ENGINEER required by manufacturer in Eastern Townships, Quebec, to work as technical assistant to the shop manager. This position would involve initially plant layout for an expansion programme for someone interested in machine tools and heavy machinery. Apply to File No. 4175-V.

MECHANICAL ENGINEERS to act as project engineers with experience in chemical or allied industry preferred but not essential. Location Ontario. Apply to File No. 4176-V.

MECHANICAL ENGINEER or graduate in engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics required for Montreal office of consulting firm. Apply to File No. 4177-V.

THREE MECHANICAL ENGINEERS, university graduates with one or more years of machine design experience. Location Montreal, office of consulting firm. Apply to File No. 4177-V.

MECHANICAL ENGINEER with about 10 years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc., required by Montreal office of consulting engineer. Apply to File No. 4177-V.

MECHANICAL ENGINEERS required by large automotive industry in Ontario for the time standards and methods department and for production engineering. Apply to File No. 4178-V.

MECHANICAL ENGINEER required in Edmonton Alberta for design of special machinery. Apply to File No. 4184-V.

MECHANICAL ENGINEER required in Province of Quebec by pulp and paper industry for deisgn and layout. Apply to File No. 4189-V.

MECHANICAL ENGINEER with pulp and paper experience required for Montreal office of the industry. Applicant should have experience in checking, draughting, recording, etc. Salary open. Apply to File No. 4189-V.

MECHANICAL ENGINEER for central engineering department of nationally known manufacturing concern. Would be located at head office in Montreal, with possible option of transferring to production field at later date. A good opportunity for recent graduate or one of 1952 graduating class. Should be interested in projects involving plants having diverse types of operations, and in design and installation of machines and equipment used in industry. Apply to File No. 4192-V.

MECHANICAL ENGINEER recent graduate or graduating 1952, with personality and aptitude for selling for nationally known manufacturer located in Montreal Would be given an extensive training in actual production before entering selling field under head office sales division. Technical background is a basic requirement but potential sales ability essential for future advancement. Apply to File No. 4192-V.

YOUNG GRADUATE mechanical engineers required for Mexico, Colombia and other central and South American locations, for a period of two or more years. This is an unusual opportunity for young engineers to be trained under superintendents in various steam and diesel power stations so that their experience would not be limited to one plant or in relationship to only one plant superintendent. After training these engineers would if they wish, be sent to head office in the U.S.A. to act as liaison officers between field and office and thus assist in the start up to new generating stations. A thorough knowledge of the English language is essential. Apply to File No. 4193-V.

OPPORTUNITY FOR A MAN in Vancouver, B.C. who is a graduate mechanical engineer and has had five to ten years' experience in laying out heating and ventilating for buildings of all types. Must have a full knowledge of hot air, hot water and steam systems and their controls. For the first year he would be on salary plus a share of the heating and ventilating profits, after which he may become a partner. Reply with full details of experience, age, references and marital status. Please enclose a recent snapshot and state salary expected. Apply to File No 4200-V.

MISCELLANEOUS

SALES ENGINEER required by expanding sheet metal fabrication company in Southern Ontario, for research and development of new products. He must be able to introduce practical ideas and develop them as established lines for our sales programme. An excellent opportunity for the right man. Write full details of experience and salary expected. Apply to File No. 4168-V.

RESIDENT ENGINEER'S assistant required by consulting firm located in Toronto. Recent graduate to assist in inspection work on project in Toronto area. Apply to File No. 4173-V.

CONSTRUCTION INSPECTOR required by consulting firm located in Toronto. Qualified engineer experienced in field supervision for travelling inspection of construction. Apply to File No. 4173-V.

MECHANICAL OR ELECTRICAL ENGINEER (preferably mechanical) required by large manufacturer in Eastern Townships, Quebec. Applicant should be interested in plant safety training period and excellent opportunities offered. Apply to File No. 4175-V.

TECHNICAL SALES engineers with experience in chemical or allied industry preferred, required by large chemical industry in Ontario. Also sales engineer with experience in injection moulding. Sales offices in Toronto and Montreal. Apply to File No. 4176-V.

A LARGE PULP AND paper mill located in Southeastern Quebec has an immediate opening for a superintendent for its 300 ton kraft mill. Applicant should be

fully experienced in mill operations, in control and study of technical problems, and in handling men. Graduate mechanical or chemical engineer with some knowledge of French. Please give full particulars of experience, education, age etc. with first reply, which will be considered confidential. Apply to File No. 4180-V.

MINING OR METALLURGICAL engineer required by organization in Montreal. Duties include contacting industrial organizations where materials are now well established. Excellent opportunity offered. Apply to File No. 4183-V.

SALES ENGINEER required with 3 or 4 years experience in sales and development of materials handling, preferably in mining or pulp and paper industry. Location, working out of Toronto or Montreal. Apply to File No. 4185-V.

RESEARCH ENGINEER required in Ottawa. University graduate in engineering specializing in thermodynamics, to conduct low temperature tests of mechanical equipment in cold chambers and to supervise operations of 1000 H.P. ammonia refrigeration plant. Some experience with plant operation and test work required. Initial salary up to $4,000 depending on age, qualifications and experience. Apply by air letter giving full details to File No. 4187-V.

TEXTILE ENGINEER required in Montreal by manufacturer of fibre into felt to supervise operations and plant maintenance. Apply to File No. 4188-V.

ASSISTANT TO SALES MANAGER of new line of products being developed by nationally known manufacturing concern located in Montreal. Would handle office routine, sales assignments in manager's absence, and serve as general understudy with object of eventually entering selling field. Should be sufficiently mature to deal with the public. Technical background would be very useful but not essential. Apply to File No. 4192-V.

MECHANICAL OR ELECTRICAL ENGINEER, to operate sub-contracting section dealing with small electronic/mechanical assemblies. Should be familiar with Canadian industry in this field and have experience handling sub-contract details. Salary dependent on qualifications. Apply to File No. 4194-V.

YOUNG CIVIL OR MECHANICAL engineer required by pulp and paper company in Quebec. Applicant should be fluent in either French or English and able to make himself understood in either. Apply to File No. 4195-V.

MUNICIPAL ENGINEER to take charge of construction and maintenance and act in consulting capacity on water and fire system in municipality on Pacific Coast. Permanent work for right person. Reply giving date available, experience, references, present salary and salary expected. Apply to File No. 4196-V.

ENGINEERING COMPANY engaged in the design, manufacture and erection of chemical process plants in Canada and U.S.A. requires the services of a field erection superintendent. Plant erection involves responsibility for field planning, organization and supervision right through to completion of the job. Company headquarters in Montreal. We prefer a civil or mechanical engineer with 4 to 5 years experience in feild erection of process equipment as used in the petroleum industry. Salary according to qualifications. Send complete resume of education, experience and recent photo to File No. 4197-V.

FOUR MECHANICAL AND THREE electrical engineers required by manufacturer of quality electrical products. Plant located in Ontario. Apply to File No. 4198-V.

ASSISTANT TO CHIEF engineer of research and control departments required by textile manufacturer in Province of Quebec. Applicant should be preferably Ph.D. with administration experience and knowledge of textile industry. Apply to File No. 4201-V.

CHIEF ENGINEER OF chemical and industrial research department of textile manufacturing plant in Province of Quebec. Applicant should have some experience in refinery practice in oil lubrications. Salary open. Apply to File No. 4201-V.

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

CHEMICAL

CHEMICAL ENGINEERS with 2 to 4 years operating experience in the chemical industry. Successful applicants will be given a 6 months special training period in the U.S.A. before being permanently located in central Alberta by major organic chemical industry in the production department. Apply to File No. 4075-V.

CHEMICAL ENGINEER required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

TWO 1952 GRADUATES in chemical engineering required by pulp and paper manufacturing company in Eastern Townships for investigations, under direction, of specific characteristics of operating processes and equipment, and of the manufactured product. Apply to File No. 4159-V.

CIVIL

YOUNG CIVIL ENGINEER for large transportation company located in Montreal in track department. Duties include general engineering work including some design. Experience not necessary. Apply to File No. 4041-V.

CIVIL ENGINEER for public utility in Toronto, Ontario to act as junior location engineer. A professional engineer with at least 2 years experience on field surveys and location, to supervise surveys for overhead and underground transmission lines, inspect field construction work. Apply in writing, stating age, education details of past experience and salary expected. Apply to File No. 4119-V.

CIVIL ENGINEER required by public utility in Toronto to act as assistant design engineer. A professional engineer with at least 2 years experience in transmission line design to assist on design work on transmission lines, conductor mechanics and fittings, steel and wood structures, footings, foundations etc. Apply in writing stating age, education, details of past experience and salary expected. Apply to File No. 4119-V.

TWO CIVIL ENGINEERS required by large engineering and construction organization as designers in structural steel and reinforced concrete. Experience required 8 years and 2 years respectively. Salary open. Apply to File No. 4149-V.

CIVIL ENGINEER required in design office of medium sized base metal mine, situated in northern Ontario. Experience in structural and plant design necessary. Salary commensurate with qualifications. Apply giving full details of qualifications to File No. 4150-V.

REQUIRED
FOR WORK AT
Montreal Office

One mechanical engineer with about ten years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc.

Three mechanical engineers, University graduates with one or more years of machine design experience.

One graduate in mechanical engineering or engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics.

One mechanical draughtsman, experienced in checking of shop drawings of machinery.

Two mechanical draughtsmen with at least three years' experience.

Apply in writing or in person to:

Manager,
C.D. Howe Company Limited,
Consulting Engineers,
1421 Atwater Avenue,
Montreal 25, Quebec.

Combustion Engineer Salesman

Preferably young man with knowledge of and experience with coal burning equipment and also flair for product research and development. Must have pleasant attributes of sales personality and willingness to travel contacting coal industrial users and retail dealers particularly in Western Canada. Prospect of advancement to sales manager upon proving suitability. Liberal salary plus bonus arrangement to right man. Travel expenses paid and car furnished if necessary. Pension plan eligibility after short period of service. Established brands and connections and producing company known for advancement in coal mining methods and preparation. Apply to File No. 4199-V.

ELECTRICAL

ELECTRICAL ENGINEER, required by manufacturer in Montreal for design of and supervision of manufacture of miscellaneous electrical panels for fire alarm systems, clock systems, etc. Correspondence re details of orders for special material. Company operates on a five day week, employs just over 100 persons, has a company subsidized sickness and accident policy plan. Apply to File No. 4107-V.

ELECTRICAL ENGINEER with about 2 or 3 years experience in industry required by chemical manufacturing organization in Province of Quebec. Apply to File No. 4126-V.

JUNIOR ELECTRIC ENGINEER required by large organization in Montreal for inspection department of the diesel locomotive division. Apply to File No. 4132-V.

RECENT ELECTRICAL ENGINEER required by manufacturer with sales offices in Montreal for sales and service work on machine tools, precision instruments, etc. Territory Kingston to Halifax. Apply to File No. 4142-V.

ELECTRICAL ENGINEER required by large communication organization in Montreal. Applicant should have 1 to 3 years experience. Apply to File No. 4143-V.

ELECTRICAL ENGINEER who has recently completed the power option course in electrical engineering from a recognized university required by paper mill in Province of Quebec. Duties would range from draughting to supervising electricians and electrical installations in the mill. Although not necessary a bilingual engineer would be preferred. Apply to File No. 4146-V.

ELECTRICAL ENGINEER, minimum 1 year's experience on test course, for specification writing, comparison of tenders, supervision of factory tests, liaison with manufacturers, checking drawings. Location Toronto. Apply to File No. 4161-V.

CHIEF OF SYSTEM PLANNING required by foreign operations of Canadian company. Well qualified electrical engineer for long range planning of generating, transmission and receiver facilities, supervision of distribution, relay-protection, carrier-current, research, and standards departments, forecasting capital expenditures. 7-15 years experience. Apply to File No. 4161-V.

WELL QUALIFIED ELECTRICAL ENGINEER for foreign operation of Canadian company. Planning underground distribution systems and allied substations, standardizing present practices, special studies, 7-10 years experience. Apply to File No. 4161-V.

Technical Salesmen

REQUIRED

Sales experience in chemical or allied industry preferred and

Sales Engineer

with experience in injection moulding.

●

Positions open with Toronto and Montreal Sales Offices

●

Project Engineers

Mechanical graduates preferred. Design experience in chemical or allied industry preferred but not essential.

●

It's an opportunity for the properly qualified man to link his future with Dow Chemical of Canada, Limited an important factor in the industrial chemical expansion in Canada.

Apply

Personnel Department

DOW CHEMICAL OF CANADA, LIMITED

Sarnia, Ontario

(Applications Confidential)

MECHANICAL

FIVE MECHANICAL or Civil engineers for design and layout of buildings and equipment for asbestos milling operations. Apply to File No. 4124-V.

MECHANICAL ENGINEER with about 2 years experience in industry required by chemical manufacturing plant in Province of Quebec. Apply to File No. 4126-V.

MECHANICAL ENGINEER required by paper company in Eastern Canada, to act as lubrication engineer. Applicant would work in close contact with plant maintenance engineers and lubrication engineers of the supplying oil companies. Age about 30 years. Salary according to qualifications. Apply to File No. 4133-V.

MECHANICAL SUPERINTENDENT with manufacturing experience in machine shop production required by manufacturer in Province of Quebec of commercial firearms. Also required process engineer capable of taking charge of engineering process. These are permanent positions in a growing business. Apply to File No. 4138-V.

SALES ENGINEER preferably mechanical for Toronto office of manufacturer of air handling equipment such as fans, heating coils, air conditioning units, etc., to contact consulting engineers and industry. Apply to File No. 4139-V.

SALES ENGINEER for Montreal office with some experience in heating and ventilating equipment and should be preferably mechanical engineer. Apply to File No. 4140-V.

MECHANICAL ENGINEER, age 30 to 35 years with some experience in general plant maintenance work for plant located in Montreal. Duties include helping to supervise maintenance and installation of pumps, motors, steam boilers, refrigeration system, etc., salary open depending on qualifications. Apply to File No. 4147-V.

MECHANICAL ENGINEER required in Montreal with experience on small assembly production lines, preferably in the electronic industry. Apply to File No. 4153-V.

MECHANICAL ENGINEER required for manufacturer of spun synthetic textile yarns at Granby, Quebec. Duties will include planning production, the maintenance of the machines, the planning and installation of new machinery and daily contact with all levels of personnel. Salary open. Apply to File No. 4156-V.

MECHANICAL ENGINEER required for foreign assignment by Canadian Company. Minimum 8 years experience including several years experience on operation and maintenance of large hydro-electric plants having reaction turbines. Must be acquainted with theory of strength of materials, fatigue phenomena, and alloy steels used in turbines. Apply to File No. 4161-V.

MECHANICAL SUPERVISOR for foreign operation of Canadian Company. Engineer with technical and practical training, including experience in body design, engine testing and timing, repair, testing and calibration of electrical units. Diesel-engine maintenance, knowledge of modern auto transmissions. Prefer single man, age up to 30. Apply to File No. 4161-V.

MECHANICAL OR CIVIL ENGINEER recent graduate required by Maritime Branch of large Canadian firm, for inside sales office and contact work. Territory Newfoundland and Maritimes. Apply to File No. 4162-V.

INDUSTRIAL ENGINEER required by large manufacturing firm in Montreal. Applicant should have experience in developing overhead and operating labor standards, time study, job evaluation, cost reduction, etc. Personality and ability to deal with people important. This company is expanding in Canada and the opening holds definite future opportunity. Man under 30 preferred. Apply to File No. 4163-V.

TWO ASSISTANT ENGINEERS required by expanding organization in Western Canada engaged in the repair of aircraft, principally for the R.C.A.F. Applicant should be graduate of a recognized engineering school and have a degree in aeronautical engineering or be familiar with aircraft through practice. His duties will be to assist in the preparation of repair schemes, distribution of technical knowledge amongst our foremen and crew chiefs, organization of various repair programs from an engineering point of view. Apply to File No. 4164-V.

CHEMICAL ENGINEERS or honour degree chemists required for several positions available in the department of chemistry by university located in Ontario. Duties include assisting in the instruction in under-graduate chemistry laboratories. Conducting problems on tutorial classes, conducting research under direction. No appointments will be made prior to March 1, 1952. Starting salaries $3270.00-$3,620.00. Apply to File No. 4165-V.

MINING

TWO MINING ENGINEERS required by large mining and manufacturing organization in the Province of Quebec to take charge of surveying work underground. Apply to File No. 4124-V.

TWO SENIOR MINING engineers required by large mining organization in Province of Quebec for underground development. Apply to File No. 4124-V.

MISCELLANEOUS

YOUNG ENGINEER required by consulting firm in Toronto for job in Western Canada with experience primarily in water and sewer installations. Apply to File No. 4122-V.

ENGINEER TO ACT as sales engineer for old established business well known throughout Canada. Applicant should be about 30 years of age with 3 years experience in the pulp and paper industry. The location is Montreal with a certain amount of time spent visiting mills in this territory. Apply to File No. 4123-V.

FOUR 1952 GRADUATES 2 mining and 2 mechanical required by large mining organization in province of Quebec. Apply to File No 4124-V.

CITY PLANNER required for Vancouver, B.C. to be responsible for the development and administration of the new city planning department in conjunction with a planning board of civic officials, to initiate and conduct studies, to promote, supervise and co-ordinate the planning and technical work with particular reference to zoning and subdivision control, to assist in formulating long-term improvement programs and through the above planning board, to act as technical consultant and advisor on matters affecting the growth and physical development of the city. Qualification, University graduation in Civil Engineering, Architecture or related field supplemented by courses in city planning, considerable planning experience including some supervisory responsibility, succesful public relations, and administrative experience in municipal government, or an equivalent combination of training and experience. Salary $7,000.00 to $9,000.00 per annum depending an qualifications. Apply to File No. 4125-V.

ASSISTANT POWER STATION superintendent required by Hydro Electric Power Commission of Ontario. Applicants should have a sound practical and technical training and not less than 10 years experience in the administration, operation and maintenance of modern high pressure turbo-generators, P.F. boilers and auxiliaries. Mechanical or electrical engineer preferred. Salary range will extend to $7,800.00 per annum depending on qualifications and experience. Apply to File No. 4127-V.

INDUSTRIAL ANALYST graduate in engineering or science wanted by large Asbestos mine in Quebec. Applicants preferred who also have some education in business administration, commerce and finance accounting. Selected individual would be trained to appraise financial desirability of making capital and operating expenditures. Age 25-30 years preferred. Salary depends upon qualifications. Apply giving details of education, experience, marital status and salary desired to File No. 4130-V.

WELDING ENGINEER required by large organization in Montreal with practical and theoretical knowledge of modern welding processes, in addition to a general engineering training. Apply to File No. 4132-V.

ENGINEER, required by City in Ontario. Applicant must be a fully qualified engineer with experience in and capable of directing the operations of road maintenance and construction sidewalks, curbs and gutters, street cleaning, snow removal and garbage collection and disposal. Experience in the operation and disposal. Experience in the operation of asphalt plants desir-

CITY OF CALGARY

Alberta, Canada

REQUIRES

An Assistant City Engineer

DUTIES:

As first assistant of the CITY ENGINEER to perform a variety of administrative and advanced technical duties of a professional civil engineering nature in assisting in the promoting, planning, co-ordinating, and supervising of various municipal engineering projects including sewers and sewage disposal, garbage collection and disposal, traffic control, construction and maintenance of bridges, underpasses, streets, roads, sidewalks and building inspection.

QUALIFICATIONS:

University graduation in Civil Engineering, preferably supplemented by post graduate work in the municipal field. Considerable, varied municipal engineering experience, including supervisory responsibility. Successful public relations and administrative experience in municipal government; or an equivalent combination of training and experience.

Apply in writing, stating salary required, to the Personnel Director, City Hall, Calgary, Alberta, not later than April 30th, 1952.

TECHNICAL EDITOR

Rapidly growing research organization (both fundamental and applied) requires first-class man to advise in the initial drafting, and carry out the final processing, of scientific and technical communications. This man must be capable of working with project supervisors toward the clear and accurate expression of research concepts and results.

A science degree and published research, plus some writing experience, are therefore essential. Academic and industrial experience are both desirable. Salary commensurate with qualifications; permanent position; central location in Montreal.

Reply giving full résumé of career to:

Employment Office,
Pulp and Paper Research Institute of Canada,
3420 University Street, Montreal

the-site observation and through drawing board activities. Apply to File No. 4159-V.

CHIEF FOREIGN WIRE relations to negotiate agreements with other utilities, study equipment protection, electrolysis and power interference. Prefer minimum 10 years experience in design operation and maintenance of telephone plants. Apply to File No. 4161-V.

RATE SPECIALIST required for operation of Canadian company. Retired from public utility, consultant to set up retail rate department. Age 60-70. Alternatively an experienced engineer with rate-setting background. Apply to File No. 4161-V.

COMMERCIAL DIRECTOR for foreign operation of Canadian company. Well qualified with utility experience to direct sales promotion, tariffs, consumer research, statistics, advertising and to correlate economics data. Apply to File No. 4161-V,

SOILS ENGINEERS experienced in soil mechanics and foundations engineering, are required by a rapidly expanding organization. Graduate soils work desirable. Location Montreal, but some travelling required. Salary open. Apply to File No. 4166-V.

AN OPENING EXISTS for a young man with engineering training to do field work and draughting in the City Engineer's department in Western Canada. Applicants with practical experience in Municipal, Consulting, Contracting or Land Surveying work will be given Preferences. All applications should be made as soon as possible stating age, marital status, salary expected, and when available. Detailed particulars of educational qualifications and experience must be given in first letter. Salary will depend upon experience. Apply to File No. 4167-V.

THERE IS AN OPENING for an ambitious young man, who is not afraid of hard work and a challenging job in the Advertising Department of a large organization in Montreal. He should have a minimum of 3 years advertising experience, preferably industrial, a degree in Engineering or Science desirable but not essential. Good salary and opportunities for advancement offered to properly qualified man. Apply with full details of experience, education and salary expected. Apply to File No. 4169-V.

SALES ENGINEER for Toronto Office of large Railway Supply organization. Practical mechanical ability an asset. Railway experience preferred, but not absolutely necessary. Excellent opportunity for young, aggressive man. Remuneration in accordance with ability. Pension plan, automobile, etc. Write, giving details and including photograph to File No. 4202-V.

Situations Wanted

MECHANICAL ENGINEER, 1950 graduate with varied experience in manufacturing, desires position in Ontario. Apply to File No. 1216-W.

MECHANICAL ENGINEER Jr.E.I.C., 1948 University of Saskatchewan graduate, 2½ years research and testing 1 year mechanical design experience. Interested primarily in the technical side of engineering. Desires new position. Apply to File No. 1458-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., married, desires change to a permanent position leading to increased responsibilities and greater opportunities. 8 years experience in light and power design layouts for industrial plants, job instruction and plant operation. 7 years experience in electric utility power plant and substation design, cost estimating and accounting, equipment specifications and contracts, and business administration. Western Canada or Ontario preferred. Apply to File No. 1632-W.

MECHANICAL AND INDUSTRIAL ENGINEER, P.Eng., M.E.I.C., graduate 1927, bilingual, first class references, experienced in production, business administration, design, methods installation, presently employed, desires responsible position. Apply to File No. 1720-W.

MECHANICAL ENGINEER M.E.I.C., P.Eng., Quebec, Technical College Stuttgart, 1924, about 18 years experience in Canada, in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area prefered. Apply to File No. 1862-W.

HEATING AND VENTILATING ENGINEER, M.E.I.C., P.Eng., member A.S.H. & V.E. Many years experience in design and layout. Ten years as head of department for large industrial firm. Available for position of responsibility or as consultant. Apply to File No. 2091-W.

CIVIL ENGINEER, B.Sc., M.E.I.C., age 42, married, with 10 years experience in construction and maintenance, including layout and supervision of water supply, sewage systems, municipal engineering, underground mining and industrial buildings. Presently employed but available on short notice. Apply to File No. 2626-W.

MECHANICAL ENGINEER, Canadian, age 37, B.Sc., M.E.I.C., P.Eng. (Ont.), 14 years experience in various phases of mechanical engineering, presently employed in a senior engineering capacity, seeking a position (preferably, if possible, in Canada) in which proven design and administrative abilities, plus hard work, allows scope for further advancement. Please apply to File No. 2745-W.

PROFESSOR OF CANADIAN UNIVERSITY, M.E.I.C., P.Eng., Ph.D., specializing in Mechanical and Industrial engineering, available for summer assignment between May and September. File No. 2929-W.

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

SALES ENGINEER with 20 years experience, sales, management, equipment design, advertising and public relations in public utility, construction and export fields is interested in making new connection. Apply to File No. 3057-W.

THREE ENGINEERS, (Grads., London) with an average of three years experience in aeronautical and mechanical engineering, desire part time work in structural, mechanical or aeronautical detailing, and stress analysis, for evenings and Saturdays, in the Toronto area. Apply to File No. 3337-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec. Experience includes 5 years as works manager of large engineering plant and covers inspection, design, manufacturing and administration. Seeks position with progressive organization where training and experience could be best utilized in administration or production. Apply to File No. 3355-W.

PROFESSIONAL ENGINEER, M.E.I.C., graduate McGill 1943, veteran, age 31, seeks position as resident engineer, project engineer or plant engineer. Extensive experience in construction of large industrial plants including sugar refinery, pulp mill, chemical and textile plants all across Canada. Experience also includes plant layout, design, alteration and maintenance work. Would consider alternative position as executive assistant or sales engineer. Apply to File No. 3405-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., A.M.I. Mech. E., chartered Mechanical Engineer, 1st Class B.O.T. Certificates, (Steam and Motor), 1st Class A.B. Stationary Engineer's Certificate. Management, Administration, Construction, Power Plant Operation. Desires more progressive position at

able. The man appointed will have complete charge of these operations together with any other duties relative to streets. Salary range $4,500.00 to $5,000.00. Apply to File No. 4134-V.

CONSTRUCTION PERSONNEL ASSISTANT required by a company undertaking major construction programme in Eastern Canada. Duties include establishing methods of operation, directing personnel staff, selecting key non-manual personnel, engineers, purchasing agents, accountants, office managers etc. Qualifications — Canadian citizen, preferably under 30 years of age, graduate engineer with construction experience, possibly plus training in business administration. Excellent opportunity. Apply to File No. 4136-V.

UTILIZATION ENGINEER required by a Canadian natural gas company experienced in all phases of service work. The company serves 75,000 meters in a number of municipalities which are grouped in four districts. Applicants must be capable of directing district superintendents in service work, installations, inspections, training programs, etc., as well as direction of a small appliance testing laboratory and preparing instalation codes etc. Applicants should state age, qualifications, experience, references and salary expected. All applications will be treated as confidential. Apply to File No. 4144-V.

SALES ENGINEER required by manufacturer of metal working compounds, chemicals for drawing, grinding, derusting, rust preventing, metal rolling, cutting and point stripping. Territory Montreal and district. Salary and profit sharing. Experience required. Apply to File No. 4148-V.

THE PUBLIC SERVICE OF CANADA requires, 2 engineers $5,980.00-$6,580.00 and three district inspectors (one bilingual) $4,940.00-$5,580.00 (operating and car equipment). Extensive railway experience is essential for these positions. Apply to File No. 4151-V.

MECHANICAL OR CIVIL ENGINEER required by pulp and paper company in Ontario. Work consists of the design and erection of buildings, installation of machinery and equipment, also certain problems involved in mill maintenance. Apply to File No. 4152-V.

RECENT ENGINEERING graduate for Montreal office. Work consists of design and price estimating on air-conditioning and refrigeration equipment. Apply to File No. 4154-V.

TWO 1952 GRADUATES in industrial or mechanical engineering required by pulp and paper manufacturing company in Eastern Townships with skill in mathematical computation and reasoning, interest in report writing. Studies of production methods, plant lay-out, materials handling, etc., wage incentives, time and motion studies, jobs evaluation etc. Full time course of 3 months duration provided at the outset. Apply to File 4159-V.

TWO 1952 GRADUATES in mechanical or civil engineering required by pulp and paper manufacturing company located in Eastern Townships, with skill in draughting, interest in engineering development work, participation in studies of mechanical and structural improvements, lay-out and design through on-

Senior Executive level. Apply to File No. 3420-W.

MECHANICAL ENGINEER, McGill 1951, S.E.I.C., S.A., age 23, single. Presently employed. Desire position with heating and ventilating firm located in Montreal. Apply to File No. 3425-W.

CIVIL ENGINEER, B.Sc., University of New Brunswick, 1949, Jr.E.I.C., age 24, single. 2 years Canadian Hydrographic Service. 7 months as field engineer on construction work. Desires position on construction work, but will consider others. Available on short notice. Apply to File No. 3429-W.

EXPERIENCED ENGINEER, A.M.I.C.E., M.E.I.C., age 32, 14 years combined Civil Mechanical background. Design and construction in road works, water supply, sewage system and large factory construction in U.K. Hydro-electric construction and investigation in U.K. and Canada. Geophysical investigation and deep well drilling and operation for water supply in N. Africa. Aircraft component design and machine shop practice in U.K. Require progressive position where experience may be utilized combined with aptitude for administration organization and production. Apply to File No. 3435-W.

PART TIME EMPLOYMENT, graduate civil engineer, Jr.E.I.C., desires part time employment in Montreal for evenings and weekends. Experience in reinforced concrete design, foundations, laboratory testing of concrete, steel and soils. Apply to File No. 3466-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng., McGill 1949, age 26, married, presently employed by construction firm in Montreal, would offer services for part-time employment in designing, estimating, etc., related to varied fields of building construction especially reinforced concrete, steel, or timber structures and foundations. Apply to File No. 3480-W.

FULLY QUALIFIED MECHANICAL ENGINEER, M.Sc., Ph.D., P.Eng., M.E.I.C. Metallurgical Statistician, fully experienced in steel production and steel products. Held top ranking positions in research and industrial development in Europe. Desires position in a Canadian organization able to offer opportunity to use considerable experience. Suitable recommendations from present employer available. Apply to File No. 3521-W.

ENGINEER ELECTRICAL AND MECHANICAL, employed in Scotland, wishing to settle in Canada, invites employment offers, where drive will bring advancement. Associate member Institution Electrical Engineers, University London, inter B.Sc., Mechanical. 5 years works apprentice, welding, machine and assembly depts., 6 years drawing office, 12 years senior appointments in production control and factory management. Experienced in production planning, factory loading, stock control, job methods, rate fixing, factory pricing, mass/batch production and budgetary control. Excellent health, 40 years of age, married two children. Bilingual. References obtainable from Canadian and U.K. executives. Full career details and photograph on application. Apply to File No. 3610-W.

GRADUATE ELECTRICAL ENGINEER, S.E.I.C., Manitoba 1951, married, one child, R.C.A.F. veteran, presently employed, desires to gain experience in electronic design. Willing to work for moderate salary during training period. Montreal or Toronto area preferred. Available on two weeks notice. Apply to File No. 3651-W.

CIVIL ENGINEER, S.E.I.C., 1952, graduate in app. mechanical option. 1 year experience in structural drawing (reinf. conc.) and some field experience. Seeks job as designer (steel or reinforced concrete) work on buildings or preferably hydo-development. Apply to File No. 3805-W.

CONSTRUCTIONAL ENGINEER, age 38, wide experience in building and civil engineering, now manager of a building firm in Switzerland, leaving for Canada in the middle of March 1952, seeks independent and responsible position as supervisor for ferro-concrete works, building and civil engineering. Apply to File No. 3806-W.

ENGINEERING AND BUSINESS, 1950 Grad., S.E.I.C., age 28, veteran, married. Desires position in sales or as assistant to sales manager on technical lines. Anxious to start at bottom, learn and climb as value to organization is established. Apply to File No. 3807-W.

EXPERIENCED MECHANICAL ENGINEER, M.E.I.C., 38, married, 2 children. 8 years chief engineer, widely travelled, experience in maintenance, purchasing, lay-out, electrical, heat treatment, handling of men and materials, problems of wear, corrosion and fatigue. Good background of metallurgy, economics, costing, statistics. At present employed, seeks senior position requiring responsibility, methodical thinking and the ability to get on well with those above and below him. Apply to File No. 3808-W.

CHEMICAL ENGINEER, Jr.E.I.C., 1949 graduate, 31 years old, veteran, 2½ years development and production (supervisory) experience in synthetic resin manufacture. Would like position (preferably in production department) in another chemical industry. Apply to File No. 3809-W.

JUNIOR EXECUTIVE. Age 31, Bachelor of Science and Bachelor of Commerce degrees. 10 years experience in electronic industry, 3½ years paper industry, 1½ years metal valve industy. Experienced in supervision, plant and equipment layout, mechanical design, expediting, production control, production methods, maintenance, plant engineering. Desires responsible position as assistant to senior executive. Apply to File No. 3810-W.

MECHANICAL ENGINEER (University Vienna, Austria) specialized in Refrigeration and Air Conditioning, experience in heating, ventilation, construction of vessels, tanks, coils, pipe lines, etc., sales management, calculations and estimates, automatic control, 10 years experience in Europe and last years in Mexico, Speaks English, French, Spanish, German. Desires corresponding position. Presently located in Ontario. Apply to File No. 3811-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., B.A.Sc., Toronto 1944. Experienced in petroleum engineering development; at present employed in business administrative capacity but planning on a change; married with two children; position must guarantee to keep me up to my ears in work and give ample opportunity for advancement. Apply to File No. 3812-W.

GRADUATE CHEMICAL ENGINEER, N.S.T.C. 1950, Jr.E.I.C. Age 25, married. Employed two summers while undergraduate with large steel plant in Nova Scotia. Employed since graduation with mining company. Desire permanent position in production organization. Interested in any position where hard work and capability leads to advancement. Apply to File No. 3813-W.

PART-TIME DESIGN WORK requested. Extensive experience in designs of air cylinders actuated devices for woodworking industries. Drafting help available, mechanical drawings detailed. Apply to File No. 3815-W.

MECHANICAL ENGINEER DESIGNER, M.Sc., M.E.I.C., wide experience in Canada and abroad, sound technical, theoretical and practical background, supervisory level. Energetic and conscientious. Desired responsible permanent position with a progressive company. Availability to be discussed. Apply to File No. 3816-W.

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

MECHANICAL ENGINEER, Jr.E.I.C., age 32, married, 6 years experience in design, construction, maintenance, administration and efficiency work in large steam power plant. Desires position either in paper industry or as a plant engineer. Apply to File No. 3823-W.

ELECTRICAL ENGINEER, 41, British, seeks employment in Canada. Toronto, Ontario, preferred. Honours diploma in electrical engineering and associate member of I.E.E. 5 years as draughtsman, 14 years as electrical and mechanical engineer in the paper and rayon industries and with the British Air Ministry. Available at two months notice. Apply to File No. 3824-W.

GRADUATE ELECTRICAL ENGINEER, Jr.E.I.C., 1950 graduate needs change. Wishes to work where he can progress in engineering. Particularly interested in power, generation or heavy industry. Experience includes mine work, summer employment in generating station, and power board. Have position with considerable administrative and supervisory responsibility, but lacking chance of advancing in chosen profession. More complete detail and references on request. Present salary over $4,000. Family man, age 28, overseas veteran. Available by summer. Apply to File No. 3825-W.

ELECTRICAL ENGINEER, M.E.I.C., graduated 1944, married, two dependents. 8 years industrial and supervisory experience, at present assistant to plant manager. Desires responsible position in production field. Experience includes both heavy electrical machinery (motors, transformers, industrial controls) and light manufacturing on a production line basis. Familiar with all phases of manufacturing particularly with labour cost analysis, modern production methods including materials handling, production control and planning and wage incentives. Apply to File No. 3826-W.

PART TIME WORK graduate electrical engineer, Jr.E.I.C., desires part time work in Montreal for evenings and week-ends. Some experience in industrial power distribution and pole line construction. Apply to File No. 3827-W.

MECHANICAL ENGINEER, B.A., B.A.Sc., (British College), Jr.E.I.C., age 26, single. Three years experience in estimating, detailing, design and selling of all classes of mechanical handling plant and centrifugal machinery in Canada and Great Britain. Desires progressive responsible position in British Isles with Canadian firm having British affiliations. Salary commensurate to Canadian scale. Apply to File No. 3828-W.

METALLURGICAL ENGINEER, Jr.E.I.C., 1948 honour graduate, married. Two years experience in technical development work on production problems, 1 year as production supervisor. Desires production or development work of a metallurgical nature. Location immaterial. Apply to File No. 3829-W.

MECHANICAL AND ELECTRICAL ENGINEER, P.Eng., Jr. A.S.H. & V.E., age 31, married. Design and supervision of installation of mechanical and electrical equipment for buildings, 3 years in contracting, ventilation and air conditioning. Last six years and presently employed with consulting engineers office on industrial and hospital design. Willing to take complete charge of project including work of junior draftsmen. Apply to File No. 3830-W.

CIVIL ENGINEER, B.Sc., University of Manitoba, 1939, M.E.I.C., P.Eng., age 35, married, two children, veteran R.C.A.F., nine years experience in all phases of construction on job and office administration, plant superintendent, experience also as resident engineer and mechanical superintendent. At present superintendent of construction in complete charge of large project in the West. Desire responsible position with good future preferably with firm in Ontario. Apply to File No. 3831-W.

GRADUATE ENGINEER, London University 1950 mech./elect. (28), recent immigrant, seeks a responsible and remunerative opening, where versatility initiative and enthusiasm would promote advancement. 7½ years experience includes: shops, radar, servomechanism and heat-transfer equipment, design and development, coupled with D.O. routine and sales and production liaison work. Also two years part-time lecturing in England. Would travel and learn French. Offers, preferably from Toronto, Montreal or Hamilton gratefully acknowledged. Apply to File No. 3835-W.

CIVIL ENGINEER, University of Toronto 1950, Jr.E.I.C., P.Eng. Single, age 24, past experience in surveying and highway construction and presently employed by steel fabrication company. Desires more progressive position with structural consulting firm or industrial organization. Southern Ontario or Montreal area preferred. Apply to File No. 3836-W.

INDUSTRIAL ENGINEER, B.A.Sc., U. of M., M.A.Sc., (Industial Organization) U. of T., Jr.E.I.C., age 25, bilingual, with 2 years experience in time and motion study, cost control and incentive plan, and production planning. Interested in working with any industry on development of time standards and new

methods. Actually with a firm in Quebec but available on short notice. Apply to File No. 3837-W.

CIVIL ENGINEER, Jr.E.I.C., 25, 1947 graduate, 5 years with consulting firms in structural design of a large variety of industrial buildings, power plants and other structures in reinforced concrete and structural steel. Interested in responsible position with any firm engaged in the design or construction of industrial or commercial buildings, or in hydro-electric, municipal, or similar work. Will also conside part time work. Apply to File No. 3838-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., age 30, married, ex senior officer R.C.A.F. Experience includes design, draughting, estimating, plant layout and maintenance. Interested in obtaining position as plant engineer or assistant. Apply to File No. 3839-W.

PROFESSIONAL ENGINEER recently arrived from England, 8 years experience in contracting and manufacture of electrical equipment in technical and administrative positions seeks employment in Toronto preferably where intelligent hard work and initiative will lead to advancement. Details and excellent references supplied on request. Apply to File No. 3840-W.

DO YOU HAVE TROUBLE getting drawings out on schedule? If so, let us help you. Engineer draughtsmen Jr.E.I.C. in Montreal available for part time work in structural and lighting layouts, wiring diagrams, etc. Apply to File No. 3841-W.

CIVIL ENGINEER, B.Sc., (Saskatchewan, 1950), S.E.I.C., age 29, married, one child. Diverse experience in construction, administration, hydraulics and hydrology. Interested in obtaining a position in a city or municipal engineers department preferably in Western Canada. Presently engaged in hydraulics and hydrologic work. Available in one month's notice. Apply to File No. 3842-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., desires part time work (evenings), in Montreal. 3 years experience in reinforced concrete design. Apply to File No. 3843-W.

EXPERIENCED CONSTRUCTION ENGINEER, B.A.Sc., P.Eng. (Ont.), desires part tme work in design, draughting, quantity take-off and cost estimates of building foundations. Apply to File No. 3844-W.

CIVIL ENGINEER, B.Eng., (McGill, 1949), P.Eng., Jr.E.I.C., age 25, married. Four years experience on reinforced concrete design and construction, transmission line surveying, tower design and manufacturing inspection. Desires position with consulting engineering firm in Montreal area. Apply to File No. 3845-W.

THIRD YEAR student in Civil Engineering at the University of British Columbia would like a position with consulting or contracting engineers during the coming summer. Speak and write: Greek, Arabic and get along with French, age 22, and will be available on May the 15th, 1952. Apply to File No. 3846-W.

CHEMICAL ENGINEERING STUDENT (third year), S.E.I.C., 22, desires suitable summer employment. Good experience more important than remuneration. Applicant has had limited experience in vegetable oils. Available in early May for four months. References supplied on request. Apply to File No. 3847-W.

CHEMICAL ENGINEER University of Toronto, 1950, Jr.E.I.C., member A.P.E.O., age 22, single. Two years industrial experience in the production of sandpapers and development and control work in the production of protective coatings and allied products. Desires position with firm, preferably in the Toronto area, where hard work and initiative will bring advancement. Available immediately. Apply to File No. 3848-W.

ELECTRICAL ENGINEER, McGill 1950, Jr.E.I.C., test course graduate of large electrical firm with experience in design and related production problems. Desires position of increased responsibility with progressive organization. Married with two small children. Apply to File No. 3859-W.

SPARE TIME WORK: Civil Engineer, M.E.I.C., seeks spare time design work in structural steel, reinforced concrete or prestressed concrete, Toronto area. Apply to File No. 3860-W.

CONSULTING ENGINEER now established in the Maritimes is desirous of representing engineering or sales engineering firms in the four Maritime provinces. Graduate civil engineer, M.E.I.C., well known by engineering people and travels throughout the area. 48 years of age. Apply to File No. 3861-W.

MECHANICAL ENG., D.L.C., Jr.E.I.C., British Grad. 1948, single. Familiar with workshop processes, 18 months hydraulic research and tests in Canada. Seeks responsible position. Location irrelevant. Available on two weeks notice. Apply to File No. 3862-W.

ASSOC. MEMBER INSTITUTION of mechanical engineers (Britain), Dipl. Eng. (Warsaw University), naturalized British subject, age 45, with 20 years experience in development of various types high speed internal combustion engines (carburettor, petrol-injection, diesel, super-charged, etc., from 20 to 1,000 H.P.), at present chief Research Engineer in a large motor manufacturers in G.B., desires position in Canada. Knowledge of French. Apply to File No. 3863-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., 3 years experience in reinforced concrete design, knowledge of prestressed concrete, also structural steel, desires responsible position with possibilities of advancement with a construction firm in Montreal. Available on 2 weeks notice to present employer. Apply to File No. 3864-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.A.Sc., University of Toronto 1948, 3½ years design experience in the pulp and paper industry. Plant layout, maintenance and general engineering. Presently employed. Desires a position with opportunity of advancement. Age 28, married. Southern Ontario, Toronto area preferred. Apply to File No. 3865-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., Ontario, B.A.Sc. University of Toronto 1946, seeks foreign employment in construction field. Experience includes field work in surveying and heavy construction, particularly the erection of steel structures, and office work in all phases of detailing, designing, estimating, and erection of steel structures, as well as general plant layout, reinforced concrete and timber design. Particularly interested in problems of management in engineering enterprises. Married, available September, 1952. Apply to File No. 3866-W.

STRUCTURAL ENGINEER, M.E.I.C., P.Eng., (Alta. and Sask.), B.Sc. (Civil), Manitoba, 1947, age 29, married, no children. Presently suitably employed but seeking position with firm of architects or consulting engineers in Vancouver. Available 2 months notice. 5 years experience in all types of construction in steel, reinforced concrete, and timber. 3 years in complete charge of design of multi-storey office buildings, warehouses, schools, etc. Also experience in supervision of personnel in drafting room, field supervision of contractors, specification writing, cost analysis, site surveying, etc. Responsible for all phases of construction from foundations to superstructure. Desire responsible position as senior designer. Apply to File No. 3867-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., married, presently employed. Six years service in pulp and paper industry. Supervising experience and ability to organize. Familiar with mill maintenance and repair work, mill construction, budget and planning. Three years as engineer officer afloat in R.C.N.V.R. Would like responsible position in industry with opportunity for advancement. Apply to File No. 3870-W.

Attention, Members

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

This will result in a better service to everyone concerned.

TELEPHONE PLATEAU 5078

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

News of the Branches

Activities of the Thirty-seven Branches of the Institute and abstracts of papers presented at their meetings

Belleville

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

January Meeting

The tenth meeting of the Belleville Branch was held at the Masonic Temple, January 14th, with 40 present.

Mr. Gurnett, chairman, opened the meeting.

Mr. Gurnett then briefly outlined the visit of Col. Grant, the chairman and secretary-treasurer to Deloro. Mr. C. R. Whittemore expressed the appreciation of the engineers in Deloro for this visit and hoped that it would be able to arrange for a meeting of the Branch to be held there early in the Fall.

The chairman advised that the annual elections of the Branch would be held at the April meeting. According to the proposed Branch by-laws, a nominating committee must be appointed before the 15th of February, to prepare a slate of officers for the new year. The chairman is automatically a member of this committee and so nominations were called for one member and one junior member to complete the Committee. Those appointed to the committee were W. C. Benger and E. L. Littlejohn.

Mr. Gurnett then called on Mr. A. D. Janitsch to introduce the speaker, Mr. J. J. Trainer, who addressed the Branch on the subject **South Africa.**

Mr. Trainer opened his remarks by noting that in the beginning all that was known of South Africa was Capetown which was a port of call for the Dutch East India ships en route to the far East. In 1652 the Dutch East India Company set up a colony which has now grown to a country of 2,500,000 whites and 13,000,000 natives.

It was pointed out that South Africa has the following minerals—gold, silver, platinum, diamonds, iron, coal, titanium, uranium, copper, manganese, chrome, asbestos, gypsum and many others. The following industrial needs are also present: citrous fruits, grapes, apples, cattle, sheep, whaling, tobacco, shark oil, leather, hard timbers, ivory, rubber and mica.

Mr. Trainer then outlined briefly the details of the main industries in South Africa.

Gold is found in the huge Rand mines which run from the Springs in the East to Randfontein in the West, about 120 miles of mine shafts, mine dumps and the huge reduction works. The outcrop of the Witwatersand gold mines was discovered by a Mr. G. Walker in 1886 and the town of Johannesburg sprang from these few mining shanties. South Africa boasts the largest crushing unit and the biggest collection of mines anywhere in the world. The gold, however, is invisible in the quartz and can only be extracted by crushing the reef to a powder and adding chemicals to loosen the gold.

Diamonds are the result of extremely high heat and are usually found at the foot of an extinct volcano. The "hole" at Kimberly in South Africa has the reputation of being the biggest man-made hole in the world, and no one has managed to throw a stone clear into the water hundreds of feet below. In South-West Africa there is a large deposit of diamonds on the sea shore and the diamonds are there for the picking. This area is marked off and guarded by police and police dogs. In 1948 exports of diamonds amounted to $48,000.00. Mr. Trainer then briefly described the process of mining and cutting the diamonds, which is a highly skilled trade. Diamond cutting used to be done exclusively in Holland and Belgium, but since the war it has been done in South Africa.

Mr. Trainer stated that South Africa has huge reserves of coal amounting to 15,000,000 tons per year. The coal is not rich but sells at $3.00 per ton. Huge quantities of iron ore are also present and these mines are fully mechanized.

Sugar is produced in Natal; and whaling is an important industry in Durban. Mr. Trainer also outlined the gypsum, copper and cement industries of South Africa.

The Government of South Africa has done much to further the growth of industry. The Industrial Development Corporation, founded in 1940 by the Government is to assist industries such as wool, textiles, foodstuffs, timber, etc. Most of the labour is made up of native males and the Corporation has done much to improve his efficiency with better living conditions. A special industrial research council has also been set up in conjunction with the South African Bureau of Standards to guarantee the quality of all goods.

Mr. Trainer closed his remarks by noting that in 1946-47, the gross value of manufacturing output in the Union was $1,476 million against $800 million ten years ago. It, therefore, appears that industrial development will make the greatest contribution to the problems of the young country based on its enormous mineral wealth, not only in gold but in coal, iron and other base metals.

Border Cities

W. A. McDougall, M.E.I.C.,
Secretary-Treasurer

H. D. Keil, M.E.I.C.,
Branch News Editor

January Meeting

The opening meeting of the new year was held in the Science Building of Assumption College where a large group learned the story of the Inter-Provincial Pipeline running 1,130 miles from Redwater, Alberta, to Superior, Wisconsin. The speaker was Mr. W. A. Hare, secretary of the Inter-Provincial Pipeline Co. He was accompanied by Mr. John Young, engineer for the Company, from Edmonton.

Mr. Hare described how the pipeline was constructed in a record time of 150 days. Three sizes of pipe were used with a different contractor installing each. Twenty-inch was installed from Redwater to Regina, 16-inch from Regina to the American border, and 18-inch from there to its terminal at Superior, Wisconsin.

The pipe sections were all welded together and each joint checked by X-ray equipment. The pipe was then wrapped thoroughly with several layers of tar and fabric and buried in a ditch 5 ft. deep and 3 ft. wide which was dug by mammoth ditch digging machines.

Originally the pipeline was designed to deliver 55,000 barrels a day at Superior and to accommodate this 12

storage tanks of 150,000 barrels capacity each were constructed. With the very rapid development of new oil fields in Alberta, however, this storage capacity quickly was found to be inadequate and by the end of 1953, 24 additional storage tanks of 217,000 barrel capacity each will be made available.

Some idea of the size of this pipeline can be realized by the fact that it holds 1,825,000 barrels of oil itself and it requires 20 to 26 days for a barrel of oil to travel its entire length. Twice a week company planes patrol the pipeline to inspect for leaks.

Following Mr. Hare's talk a coloured film was shown of the construction work and a lengthy question period concluded the meeting.

Ladies' Auxiliary

The inaugural meeting of the Ladies' Auxiliary to the Border Cities Branch was held January 31st at the home of Mrs. A. D. Harris, Riverside Dr., Windsor. Mrs. G. G. Henderson installed the following officers: president, Mrs. G. W. Lusby; first vice-president, Mrs. J. Hoba; second vice-president, Mrs. D. A. Sinclair; recording secretary, Mrs. J. M. Wyllie; corresponding secretary, Mrs. P. S. Dewar; treasurer, Mrs. J. Brown and counsellors, Mrs. G. G. Henderson, Mrs. W. R. Mitchell and Mrs. H. D. Keil.

After the installation ceremony Miss Eleanor Cruickshank gave a most interesting talk on "Impressions of Conditions in Europe in 1951". Tea was served by Mrs. C. G. R. Armstrong and Mrs. P. E. Adams pouring and the wives of the E.I.C. executive assisting in serving.

The formation of the auxiliary was first suggested when the wives of the 1951 E.I.C. executive, with the assistance of some of the wives of past chairmen, met at the home of Mrs. H. D. Keil to plan the first dinner dance of the branch to be held at the Essex Golf & Country Club. From the enthusiasm shown it was evident that an auxiliary would be successful and a questionnaire was sent to all the wives of the branch. The response was very gratifying and indicated a keen interest not only in an auxiliary but also in the formation of additional groups including afternoon and evening bridge, handicraft and an evening social group for both husbands and wives.

The first social gathering of the wives was a tea held at the home of Mrs. G. W. Lusby on Saturday, December 1st, 1951, when the plans for the formation of the auxiliary were officially announced.

The Border Cities Branch is pleased to see that this initial enthusiasm has resulted in the formation of an active organization.

February Meeting

The regular monthly meeting was held in the Science Building of Assumption College on Thursday, February 14th. On this occasion the Branch deviated from the usual engineering topic and a very interesting talk on **This Business of Investing** was heard. The speaker was Mr. T. K. McNair of the investment firm of Wood, Gundy and Co. Ltd.

Mr. McNair commenced his talk by describing the various features of the two main investment securities; bonds and stocks. He then outlined the basic difference between an investment dealer and a stock broker and illustrated by example the typical procedure of a company obtaining money for an expansion of business by making use of an investment dealer.

In speaking of investing in the stock market, he commented that the number of people that have "cleaned up" were very much in the minority. The real money that had been made had been made by people who had bought sound securities and stuck with them. Mr. McNair then outlined the following "do's" and "don'ts" in buying stocks as listed in the book entitled "Bernard Baruch, Park Bench Statesman".

1. Don't speculate at all unless you give all your time to it and make it your life work. Amateurs always go broke.
2. Always keep a strong cash reserve. Under no circumstances trade on margin.
3. Never buy a stock unless you have studied and know everything possible about the company.
4. Be sure your facts are up-to-date.
5. Never hesitate to admit that you are wrong. Don't let pride prevent you from getting out and cutting losses as quickly as possible.
6. Never try to buy at the bottom and sell at the top. Successful operators never do it.
7. Be patient, never yield to an impulse to plunge.

The speaker concluded by saying that today we had an unparalleled opportunity in Canada. The eyes of the world were focused on our vast resources of mineral wealth, petroleum, fisheries, forests and hydro power. Now is the time to start an investment programme that would share in the payoff in the years ahead.

At the close of the meeting, Mr. McNair distributed a booklet entitled "Investment Terms and Definitions" and a memorandum giving examples of investment portfolios.

Cape Breton

G. W. Ross, M.E.I.C.,
Secretary-Treasurer

S. G. Naish, M.E.I.C.,
Branch News Editor

January Meeting

On January 22nd, Mr. Robert Tibbetts, president of the Tibbetts Paint Ltd. gave an interesting address to the Cape Breton Branch of the Institute. Mr. Tibbetts made special mention of paints to resist the Nova Scotian climate.

After the address nearly everyone in the gathering asked Mr. Tibbetts about a particular paint problem.

The meeting was under the chairmanship of Gordon Naish. Lloyd Parsons, councillor of the Moncton Branch, Blair Purvis and Bob Pierce were guests. New member Roy Leslie and new affiliate member Charles Anderson, were introduced to the meeting by Herbert Marshall, Branch president. Secretary-Treasurer Gordon Ross, made an announcement regarding National Defence.

The speaker was introduced by Councillor, Cliff Murray, and thanked by Gordon Naish.

The fact that the question period was longer than the address indicated this as one of the most popular meetings held.

Cornwall

John A. Sarjeant, Jr.E.I.C.,
Secretary-Treasurer

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

Tour of Paper Mill, January

Members of the Cornwall Branch enjoyed a tour through part of the Howard Smith Cornwall mill on January 18th. Invited guests included local members of the Ontario Association of Professional Engineers, as well as three A.S.M.E. members from Potsdam, N.Y.

Around 40 men gathered in the assembly room, and examined a display of end products made from Howard Smith paper, as well as flow sheets depicting the mill's activities. After a short business meeting, four speakers were introduced. Mr. H. E. Mason, manager of Cornwall Division, welcomed the guests and outlined some interesting facts about this division. For a number of years before and during the last war, production had been increased mainly by technical improvements to existing equipment. Then in 1946 an expansion programme began which is now nearing completion. The new Number 1 Paper Machine, which started producing paper on November 12, 1951, is the most spectacular feature of this programme. It is the first new machine in the fine paper industry in more than 20 years. Mr. Mason also mentioned his company's pride in the fact that alongside No. 1 runs No. 5 Machine installed in 1927. The latter is the second newest machine built for the production of fine paper. Statistics show that 342 persons were employed at the mill in 1920, this number swelling to about 1,700 at the end of 1951. During this period, the total yearly payroll jumped from $373,000 to more than $5,000,000.

Cornwall Branch visit to Howard Smith Paper Mill, January 18.

Some Canadian Users of Timber Structures Products

DOMINION OF CANADA:
Navy
Army
R.C.A.F.
Department of Public Works

ONTARIO GOVERNMENT:
Ontario Agricultural College
Ontario Hydro-Electric
Department of Public Works

FACTORIES & WAREHOUSES:
General Motors
Ford
Johns-Manville
Canadian International Paper
N.B. Pulp & Paper Co.
Imperial Tobacco Co.
Coca-Cola Ltd.
Hollinger Consolidated
Sudbury Mines; Mill Smelting Co.
Supertest Products
Quebec & North Shore Paper Co.
Kingston Shipbuilding Co.
Leland Electric

STORES:
Loblaw's Stores Ltd.
Dominion Stores Ltd.
Power Food Markets
Safeway Stores Ltd.

SCHOOLS:
Sherbrooke, P.Q.
Waterdown, Ont.
Humber Valley School, Toronto
Sacred Heart College, Sudbury, Ont.
Ascension Convent, Chicoutimi, P.Q.
Malartic School
King George V School, Chippewa, Ont.

CHURCHES:
In Montreal, Toronto, Peterborough, Hamilton, Murray Bay, Niagara Falls, Halifax, Sault Ste. Marie, Oshawa, Orono, Lansing, Deep River

COUNTY BUILDINGS AND FALL FAIRS:
South Brant Agricultural Society
Municipality of Caradoc Township
Dorchester Agricultural Society
County of Kent
Peel County Agricultural Board

ARENAS AND CURLING CLUBS:
Huntsville Curling Club
St. Catharines Curling Club
Brockville Arena
Bowmanville Memorial Rink
Espanola, Fort Frances and La Sarre Rinks
Keene Arena
Dixie Arena

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Mr. H. Meadd, M.E.I.C., plant engineer, next traced some of the history of the mill from 1927 on. In that year, a new machine room was built for No. 5 Machine, over the old No. 1 Machine building. This was accomplished without disturbing the old building or shutting down the machine. Only after No. 5 was in operation, was No. 1 scrapped and the old building torn down. The new building had been made large enough to house a second machine, and for many years this extra space was used for storing various pieces of equipment. Then in 1947, the machine room was extended and a stock preparation building added. In 1950, No. 5 Machine was speeded up by adding a number of dryers. During 1951, footings for the new No. 1 were built in progressive stages, while auxiliary equipment for No. 5 was being moved. In the meantime, contracts had been let for No. 1 in 1950, so that by mid 1951 parts were beginning to arrive. Assembly of the machine was completed by early November. Engineering for the installation was carried out mainly by the Cornwall staff of the company, with assistance on reinforced concrete work from the L. H. Schwindt Co. of Hamilton.

The assistant plant engineer, W. H. Young, then described the process of preparing the stock, or furnish, for the new machine. Using a large outline drawing for illustration, he showed how pulp fibres, both in slush and lap form, are mixed in a hydrapulper. All feeding and dumping operations for this machine are controlled from a semi-automatic Bailey Meter Co. control panel. He then showed the flow of the mixture through a Brammer consistency regulator to a chest with constant level control. The stock was next traced through a constant volume control box to Sutherland refiners where the fibres are cut to the proper length and the ends frayed out, to make them suitable for paper manufacture. After that, he showed how the stock could pass directly to the paper machine, or go through a Jordan for further treatment. By passing stock directly into the machine after refining, the Howard Smith staff has not followed the conventional system of storage in a machine chest, ahead of the paper machine. However, the system works well, since any errors in stock supply can be detected on the machine, and corrected in a few minutes. A fan pump delivers the refined fibres, along with a large quantity of water, to the machine.

T. B. Webster, Jr.E.I.C., one of the Howard Smith engineers, next picked up the story. An elevation drawing of No. 1 Machine was projected on the screen, and Mr. Webster described the function of the screens which break up fibre bundles. He traced the flow through a headbox which distributes the flow evenly across the machine. An adjustable gate (the slice) spreads the stock, now over 99 per cent water, onto a moving wire screen, called a fourdrinier. This screen, which has a sideways shake to felt down the fibres, removes about 20 per cent of the water. Further quantities of water are removed as the wet sheet passes through the first and second presses. Then a smoothing press removes wire and felt marks on the sheet. Next comes a section of 26 steam heated dryer rolls, designed for a pressure of 50 p.s.i. Felts hold the damp sheet against these rolls. At the end of this section there is a size press which applies starch size to both sides of the sheet, to remove fuzz and provide a surface suitable for printing. A section of 9 after dryers completes the drying. The calender stack is a series of rolls mounted one on top of the other. Here the sheet passes down between the rolls, which apply their weight and form a smooth finish to the sheet. The paper is then wound on a reel into a wide preliminary roll. The last stage is the winder, which unwinds the jumbo roll, cuts it into selected widths and rewinds each section into a tight finished roll.

W. H. Young then returned and described the steam control system for the dryers, illustrating his comments on a blackboard. Steam from the boiler main at 175 p.s.i.g. is reduced to 90 p.s.i.g. in a low pressure header, which feeds six dryer sections as well as the felt dryers. Four panel boards control the system through a series of different arrangements, with suitable interlocking to a master control. The whole condensate system is operated under a vacuum of 10″ mercury.

The filter plant was visited first. As it takes 90 tons of water to make one ton of paper, the facilities for handling up to 35,000,000 gallons per day were described. Sand filter beds provide extra clean water for the paper mill, whereas screens clean the water sufficiently for the pulp mill. Pumps for distributing the water throughout the mill were seen later in the basement.

The visitors next inspected a Sveen-Pedersen Save-all capable of handling 1,200 g.p.m. of the white water which drains off at the wet end of No. 1 Machine. By introducing air, as well as glue and size into the white water, pulp fibres and clay in the water are made to rise to the surface in the cell. Slow-moving paddles wipe off this surface material which is returned to the system. Most of the cleared water is now sewered, but later will be used again. Up to 98 per cent recovery of materials is possible.

The hydrapulper system, with its control panel and measuring tank was the next item. The batch system of charging the pulper was described. Then the groups saw how the Brammer regulator controlled the consistency of the beaten up pulp before it passed to the Sutherland refiners. The fan pump feeding the completely prepared stock to No. 1 Machine, was seen later in the basement.

The main attraction, No. 1 Machine, was inspected from the control panel at the wet end to the winder at the dry end. The guides showed the visitors how the Fourdrinier section can be rolled out into the aisle, when the wire screen has to be changed. The screen is of phosphor bronze and is 163 in. wide by 88 feet long, made in the form of an endless belt. It costs about $1,350.

Various gadgets, such as automatic guides for keeping the fourdrinier wire and press felts running straight, were inspected. The system of collecting hot moist air, over the dryers, in an aluminum hood with fibre glass insulation on top was described. Steam control panels for the dryers were pointed out. A quick trip through the basement enabled the groups to see the concrete structure for the machine, a beater for repulping rejected paper, vacuum pumps, the white water collecting system, and the hydrapulper foundations. Then the tour passed along the back side of the paper machine. The 600 hp. drive motor, with 40 V belts driving the line shaft

was shown. The system of drives to each section of the machine, were pointed out, each with its air-flex clutch, variable pitch sheave, and speed reducer. By proper manipulation, the machine tenders can take up slack in the paper sheet, at each of the drive stations.

In the finishing room, the visitors saw how the paper is unwound off the rolls to be cut into sheets. Then the sheets are inspected, counted, trimmed to final size and packed for shipment.

Refreshments were served in the cafeteria, and paper samples and flow sheets were handed out as souvenirs of the trip. During this period of relaxation, the visitors began to collect their impressions of the tour and realize why No. 1 Machine and its auxiliaries represent a 2½ million dollar installation.

Halifax

W. E. Jefferson, M.E.I.C.,
Secretary-Treasurer

J. P. Dumaresq, M.E.I.C.,
Branch News Editor

Annual Meeting, January

The annual joint banquet was held at the Lord Nelson Hotel on Monday, January 28th, at 6.30 p.m. 344 members and guests attended, in addition to a number of guests at the head table, including such old friends as Dr. J. B. Hayes and Dr. F. H. Sexton.

The speaker for the evening was D. Leo Dolan, director of Dominion Travel Bureau, Ottawa. Mr. Dolan spoke on the **Impact of Tourist Traffic On Our Canadian Economy.** He talked on the tourist industry, and urged greater fish and game conservation measures in Nova Scotia "to protect one of our greatest tourist attractions". Nova Scotians, he said, were "directors of the greatest trust company in the world, the fish and game industry".

The Travel Bureau chief also saw possibility of Nova Scotia's becoming a "great convention centre during the months of June and September", and urged that greater attention be directed to this possibility.

He also urged Canadians to travel more in their own country. He noted that last year Canadians spent $216,000,000 in the United States.

The joint banquet this year was in every way up to the usual high standard for this gala annual affair of the engineers of Nova Scotia.

Favours were distributed from several firms.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

Bernard Warren, Jr.E.I.C.,
Branch News Editor

December Meeting

A meeting of the Hamilton Branch of the Institute was held in the Science Lecture Room of McMaster University on December 13. Chairman E. T. W. Bailey turned the meeting over to Mr. L. C. Sentance, works manager of the Apparatus Division, Canadian Westinghouse Co., who was to be the moderator of the panel on **How to Operate a Manufacturing Plant.**

Mr. Sentance announced that Mr. F. H. Sherman, of the Dominion Foundries and Steel was unable to be present, but that Mr. C. S. Finkle, works manager of the Studebaker Corporation of Canada and Mr. T. O. Watts, factory manager of the Hoover Company would participate in the forum.

Mr. Finkle stressed the importance of proper organization before attempting to start manufacturing. He discussed briefly, the organization of his plant, and the functions of the Sales, Purchasing, Manufacturing, Personnel, and Comptrollers departments. "Manufacturing is simple," he said, "if you have your organization set up properly.

The moderator, Mr. Sentance, participated in the forum, and by means of slides, described the main functions of a manufacturing plant.

Mr. Watts spoke on Industrial Relations, maintaining that the difficulty of good relationships increases with the size of the plant. The human factor predominates in company-union relations and he emphasized that sincerity is a fine qualification for the good negotiator to possess.

The speakers were allowed about 15 minutes each so that there would be ample time for a discussion period. A number of interesting and provocative questions were directed in writing to the panel. In answer to the query "Are workers duped by Communist Unions?", Mr. Watts replied that they only go along with the party who can get them the most money. Quality control was defined as the analytical solution of trouble. Quality, it was pointed out, must be built in a product. When asked the cause of lower production in England, a member of the panel thought it was the result of "real" returns derived by the men.

A number of questions directed at Mr. Finkle created an interesting discussion

on the manufacture of automobiles, and was concluded by the statement that bugs in a new model are never ironed out entirely.

Mr. Gerry Connor expressed the thanks of the Branch to the panel.

After an additional word of thanks, Mr. Bailey adjourned the meeting with the invitation to continue the discussion over refreshments.

Annual Meeting, January

A very successful annual meeting of the Hamilton Branch was held at the Muirhead Cafeteria on January 17, 1952.

Following a reception at 6.15 for the members, a fine roast beef dinner was served to the group of 90, and was enjoyed to the full.

After the dinner, those who were seated at the head table were introduced. Among those present were: Messrs. A. C. MacNab, chairman of the Kitchener Branch of the Institute; Dr. A. M. Burm, Chemical Institute of Canada; W. L. Hutchison, vice-chairman of the Hamilton Branch; Dean H. S. Armstrong, of McMaster University; W. E. Brown, Hamilton Branch councillor; W. H. Chilman, chairman of the Hamilton Construction Association; G. L. Schneider, secretary-treasurer of the Hamilton Branch; and E. T. W. Bailey, chairman of the Hamilton Branch.

Mr. W. L. Hutchison was called upon to introduce the speaker of the evening, Mr. W. H. Durrell, general manager of Hollinger-Hanna Limited, agent for the Iron Ore Company of Canada, the organization developing Labrador Iron Ore Deposits.

Mr. Durrell, in an extremely interesting and revealing story, told of the vast resources available in this section of the country, and explained why the Americans had so much more capital invested in the project than did Canadians. The Canadian financiers are slow in coming forward with the dollar in such a monstrous undertaking necessary to exploit this great area of wealth.

Concluding his remarks, the speaker was thanked by Mr. Harold Cooch, M.E. E.C., chairman of the board of directors of the Canadian Westinghouse Company.

Carrying on with business, Chairman E. T. W. Bailey asked that minutes of the last meeting be adopted as written, as was the financial report. The membership committee noted an increase of from 346 in 1950 to 381 in 1951. The nominating committee for 1953 was set up.

Mr. Neil Metcalf asked Dean Armstrong to convey the thanks of the Branch to the board of governors of McMaster University. Dean Armstrong replied for President Gilmour who was in India.

Mr. E. T. W. Bailey, retiring Branch chairman, handed over the gavel of office to Mr. W. L. Hutchison, the incoming chairman, who paid tribute to the fine work of Mr. Bailey and his 1951 executive.

Mr. T. Vollmer expressed the appreciation of the general membership for the good work of the retiring executive and the new executive was asked to stand and be identified.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

"Ladies Night" Dinner Meeting

Members and guests of the Lethbridge Branch of the Institute gathered

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at the Marquis Hotel on Saturday, January 19, for a "Ladies Night" dinner meeting. P. E. Kirkpatrick presided as chairman.

Vocal solos were rendered by Mr. W. Gordon and Miss A. Findlay, G. S. Brown ably led in community singing. The Brown Instrumental Trio supplied the dinner music.

A. Donaldson introduced the speaker Mr. J. M. Davidson, manager of Lethbridge Collieries, who took the audience on a vivid photo slide tour of various points of interest in Europe. These pictures were taken during Mr. Davidson's trip to Geneva, Switzerland, in May 1950, when he attended the International Labour Organization Conference.

The pictures followed Mr. Davidson's journey through Ireland, Geneva, Paris, London, and showed various displays at the festival of Britain, Edinburgh and other parts of Scotland and lastly a few colourful views of places of interest across Canada. Mr. Davidson ably explained each picture as it was shown.

N. H. Bradley moved a vote of thanks to Mr. Davidson for taking the members and guests of the branch on this excellent tour of Europe.

Montreal

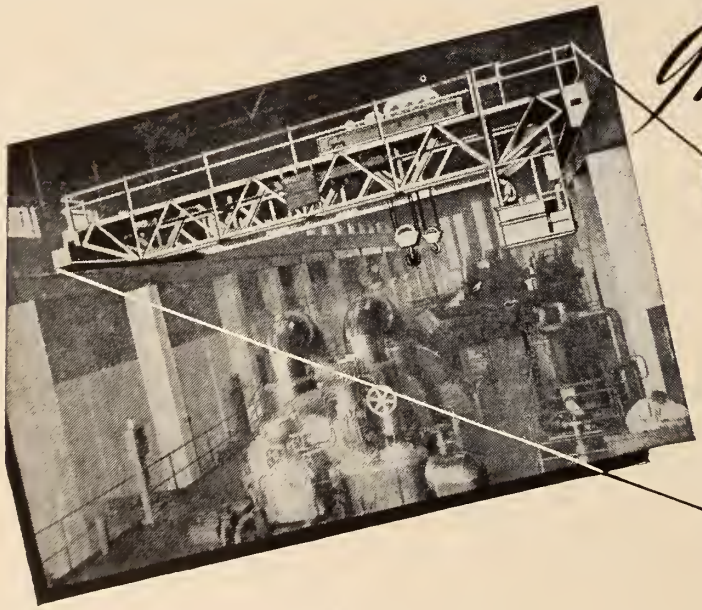
R. B. Wotherspoon, M.E.I.C.,
Secretary-Treasurer

Annual Meeting, January

The 33rd annual general meeting of the branch was held at Headquarters on January 31, with about 70 members present. The main part of the meeting was taken up by a lively discussion on the branch's program activities with particular regard to the small attendance at a number of meetings. The general opinion expressed was that with the introduction of technical section meetings, large attendance could not be expected until members came to realize the additional benefits being offered. It was felt that committees concerned should not feel discouraged with the early results.

The outgoing chairman, Mr. E. R. Smallhorn, requested Messrs. Heartz and Massue to escort the incoming chairman, Mr. F. L. Lawton to the chair. Mr. Lawton is a past chairman of the Arvida Branch and is well known throughout the country by those con-

New executive of the Montreal Branch who took office in January. Left to right: R. B. Wotherspoon, secretary-treasurer; G. N. Martin, vice-chairman; E. R. Smallhorn, retiring chairman; F. L. Lawton, chairman; Eric Smith, C. R. Frost, and L. Cartier. R. L. Dunsmore is on the left, but the photographer fumbled the shot.



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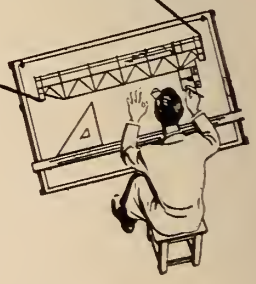

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nected with hydro electric power. He is chief engineer, power, at the Aluminum Laboratories Ltd.

The executive of the Branch for 1951 will be as follows: chairman, Mr. Lawton; vice-chairman, G. N. Martin; committeemen, 1952, L. Cartier, R. L. Dunsmore, A. T. E. Smith; committeemen, 1952-53, J. H. Budden, C. E. Frost, T. A. Monti.

Following the formal meeting, refreshments were served in the auditorium.

Moncton

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

R. A. Park, M.E.I.C.,
Branch News Editor

Ladies Night, January 25

Informality and good cheer highlighted Ladies Night, the social event of the branch winter season. The affair was held January 25th at the Rockaway, about five miles from Moncton, and was attended by eighty-eight members and guests.

For the first hour, the gathering was entertained by piano and solo-vox selections. Dancing and cards followed, music being furnished by recordings over the address system. Prizes were won by Mrs. K. A. Mellish and Mrs. C. L. Trenholm. Later, a buffet supper was served.

The activities of the evening concluded with a very pleasing feature, the presentation of a silver tray, suitably engraved, to Mr. and Mrs. V. C. Blackett, in appreciation of the former's long service as secretary of the Moncton Branch. The presentation was made by the branch councillor, R. L. Parsons, who referred to Mr. Blackett's service in office of over twenty-five years as a record for all the branches of the Institute.

Arrangements for the evening were in charge of branch chairman E. M. Nason, with the co-operation of the program and attendance committees.

Supper Meeting, February 19

Cement and Concrete was the subject of an interesting address by A. W. Purdy, M.E.I.C., at a supper meeting of the Moncton Branch of the Institute on February 19th at Cy's Sea Food Bar. Mr. Purdy is sales manager of the Maritime Cement Company, Ltd., and a graduate of Queen's University. He was introduced by W. D. G. Stratton, vice-chairman of the Moncton Branch, who presided at the meeting.

Mr. Purdy spoke briefly on the new cement plant at Havelock, N.B., which is known as Canada Cement Co. No. 2 and which has been producing since January. The process used in the plant, said the speaker, is known as the dry process. He extended a cordial invitation to the Moncton Branch for a conducted tour of the Havelock plant in the spring.

Mr. Purdy mentioned the great demand for cement. During the years from 1933 to 1945 there was an average yearly production of 45,000,000 bags in Canada, he said. Since 1945, due to great expansion in hydro development, building and defence projects, production has increased about 55 per cent. This increase in production has greatly overtaxed the equipment of the plants. However, Mr. Purdy said, with new plants now in production, and future expansion in the offing, a surplus of cement is expected in 1953. This will give plants time for proper and needed maintenance of equipment.

Mr. Purdy then showed a technicolor film prepared by the Portland Cement Association in Chicago and entitled "The Drama of Portland Cement". The film showed how Portland cement was discovered and its subsequent development and manufacture from quarry to the finished product. It showed the part cement is playing in the modern world and dwelled at length on the excellent safety record of Portland Cement plants in America.

The second half of Mr. Purdy's address was of a more technical nature and dealt with air entrained concrete. A great discovery was made when it was found that air entrained in concrete greatly increased its durability and strength, he said.

By adding an air entraining agent to a concrete mix under proper control, billions of minute air bubbles are entrained which greatly reduce the disintegration of concrete by freezing and thawing, he explained. The limits of entrainment are from 4 to 6 per cent by volume per cubic yard of cement, he added.

Tests, said Mr. Purdy, of air entrained concrete through 470 accelerated cycles of freezing and thawing had shown little effect on the concrete. On the other hand after 50 cycles on concrete without air

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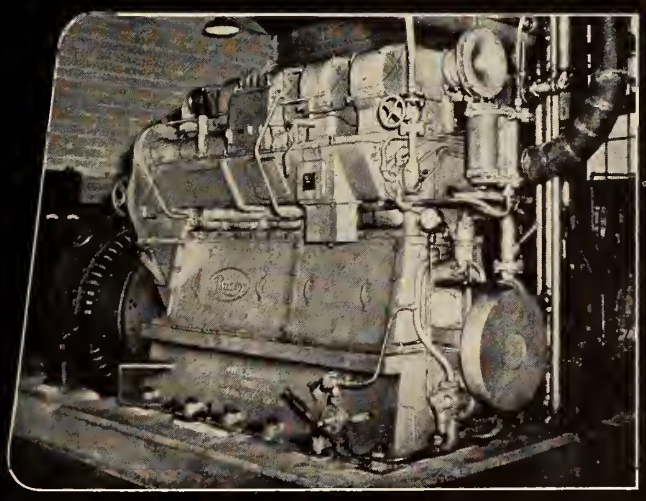

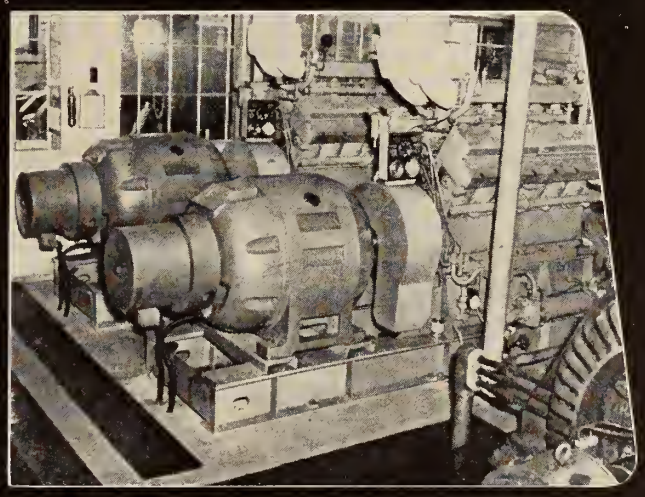

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entrainment, disintegration began. With its attributes though, good control in the mixing is required for desired results, he said. Mr. Purdy ended his address by commenting that good concrete can be made from stone, cement, water and air. Poor concrete can also be made from the same components.

R. L. Parsons, councillor for the Moncton Branch expressed the thanks of the gathering to Mr. Purdy.

Niagara Peninsula

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

J. S. Ellis, Jr.E.I.C.,
Branch News Editor

January Meeting

The January meeting took the form of an address on **Leadership** by Dr. Herbert Moore, consulting phychologist.

The speaker was introduced by Mr. Graham Bennett, acting chairman of the Branch. Dr. Moore first considered the background of leadership training. He stated that courses in leadership were instigated by British industrial concerns over twenty years ago. Industries in the United States first introduced such training about fifteen years ago but Canadian companies have been slow in following the British and American examples. Dr. Moore advocated that Canadian universities should sponsor courses in leadership. The speaker then outlined the desirable characteristics of a leader and his remarks on this phase of the subject were most thought provoking. The speaker was thanked by Mr. J. H. Ings, M.E.I.C.

At the conclusion of the meeting a presentation of a gold E.I.C. pin was made to Mr. W. R. Manock by Mr. Paul Buss. Mr. Manock has served the Branch and the Institute for many years and is retiring from business and leaving the area.

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Copies of a preliminary statement describing the main features of the Project are available now from the New Zealand Government Trade Commissioner's Office, 609 Sun Life Building, Montreal. This preliminary information is given now so that contractors desiring to submit tenders may make early arrangements to visit the site and gain an appreciation of local conditions.

Peterborough

J. P. Watts, M.E.I.C.,
Secretary-Treasurer

M. V. Powell, M.E.I.C.,
Branch News Editor

Annual Meeting

The Branch annual meeting, in the form of a smoker, was held at the Kawartha Golf Club on Friday, February 1st with Mr. A. J. Bonney in the chair. The speaker of the evening, Dr. Herbert Moore, was introduced by Mr. Roy Bogle who mentioned that Dr. Moore was well qualified to speak on Labour-Management problems having taught the subject, written a book on it, and having been employed as a consultant for many years by industries across Canada.

Dr. Moore stated that Canadian industry must take more interest in choosing and developing leaders for all levels from that of foremen up to top executives. He claimed that we have an abundance of men of high mental calibre to fill technical jobs but in many industries have sadly neglected the training of future leaders. The qualities found in a true leader are, to name a few, enthusiasm, dependability, calmness, fairness, courage, good judgment and tolerance. A good leader not only gets the job done but builds the men under him into better workers and future leaders. He is always progressive and sees into the future. He will listen patiently to new ideas, knows how to develop them and follows up to make sure that they are carried out. Foremen are most important leaders in industry and should be able to foresee and forestall the majority of grievances. They must not either try too hard to please or be too dictatorial. At the higher level of division or general managers, the successful leader is a man who is continually being driven upward by a desire for personal achievement. He is a man whose job is not to drive but to lead and build up his staff.

Mr. H. R. Sills moved a hearty vote of thanks to Dr. Moore for his inspiring address. The business meeting which preceded the address was short and interesting. The reports other than the more serious treasurer's report were presented somewhat humorously. The evening ended with a buffet luncheon.

Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

S. T. Solinski, Jr.E.I.C.,
Branch News Editor

Field Trip to Bagotville Air Station

On the afternoon of January 19th a joint field trip with the Saguenay Branch of the C.I.C. to the R.C.A.F. air station at Bagotville took place. Transportation was provided by special buses from Arvida to Bagotville where on arrival the members were welcomed by Wing Commander Christmas, commanding officer of the station. The members were then divided into four groups for a tour of the base.

The first highlight of the tour was a short address in which the basic theory of jet propulsion and the development of jet aircraft was described. Judging from the questions that followed the members were highly interested in this talk.

The control tower was the next point on the program, where the officer in charge described the functions and the operation of the modern equipment necessary for control of flying at the base. The general operation of the control tower was illustrated by giving orders to a Harvard trainer flying about the base.

The tour continued to the Supply Section where the storing and organization of all materials was explained. It was interesting to note the vast amount of equipment and supplies required at this air station. A close inspection of an F-86 Sabre jet followed. The number of instruments in this aircraft was astounding to the layman.

The four groups then convened to witness a spectacular flying display carried out by three F-86 Sabre jets and one T-33 jet trainer. It was exciting to see the formation flying at low altitudes over the airport, approaching soundlessly and making a deafening roar as it passed the observation post. Following this display hot coffee was served in the hangar after which the visitors adjourned to the officers' mess. This informal gathering gave the members an opportunity to meet the pilots and other personnel at the base.

Mr. B. L. Davis chairman of the section, in thanking Wing Commander Christmas for such a splendid and successful tour, expressed the feelings of the members very well in stating that this was one of the best field trips which the section had had the pleasure of attending.

December Meeting

On December 11th, 1951, Dr. A. Bois spoke to the Saguenay Branch on the subject **The Development of Executive**

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Personnel. Dr. Bois stressed the necessity, in modern industry, of training management executives scientifically, and described in some detail the application, in his own "Executive Methods", of the science of General Semantics.

The evolution of methods of training executives was reviewed briefly. The practical methods, including industrial apprenticeship, job rotation, executive assistantship, and the study of books written by successful executives, have gradually begun to blend with the theoretical methods, including formal courses in universities and schools, until today the time is ripe for the growth of an applied scientific method. Dr. Bois briefly described the pure science of solving human relations, first developed by the Polish engineer, Alexander Korzybski. This science is known as General Semantics. He referred to the contribution of the Institute of General Semantics in applying the science to the development of executive personnel, and to the growth of training facilities.

Dr. Bois described General Semantics as the science of the meanings of changes in speech-forms insofar as they affect the reactions of one person to another. He illustrated by showing how, in any one language, a word or phrase may awaken in the hearer or reader a whole train of psychological reactions.

Dr. Bois' humorous anecdotes of Alexander Korzybski and of his own personal experience in this field high-lighted his popularity and ability as a speaker. The question period following his address indicated the appreciation of the audience for a thought-provoking address.

The speaker was introduced by Vice-Chairman D. F. Nasmith, M.E.I.C., and thanked by Mr. T. A. Wootton.

February Meeting

On the 19th of February, Mr. M. F. MacNaughton presented a paper, **Freezing as a Factor in Determination of Concrete Structures.** Mr. MacNaughton who is presently chairman of the A.C.I. Committee 604 on Winter Concreting Methods was one of the pioneers in determining reasons for winter concrete failures and how these could be averted.

The speaker introduced his talk by saying that certain concretes, especially in sidewalks and roads were very prone to spalling during the seasons of repeated thawing and freezing. However no definite reasons could be given although many theories were brought forward to explain this phenomenon. The building of a machine by Mr. MacNaughton to duplicate these conditions of thawing and freezing was helpful in eliminating numerous theories in existence. By careful experimentation it was found that the proper percentage of entrained air which was present as very small voids in the concrete was the answer to prevent spalling on repeated freezing and thawing of concretes. These small voids act as expansion chambers on freezing of water preventing breakage of the concrete. However the speaker stated that accidental entrapped air which occupied larger spaces is of no benefit and that the entrained air must be uniformly dispersed throughout the concrete to obtain the desired results.

The speaker then continued with the showing of slides. Field and laboratory samples with and without entrained air which had been passed through 150 cycles of freezing and thawing illustrated very well the benefits of air entraining agents. The evening was concluded with a very interesting question period.

The speaker was introduced by Mr. B. L. Davis, chairman of the Branch and thanked by Mr. D. F. Nasmith who ably expressed the thoughts of the forty members present in stating that Mr. MacNaughton's paper was one of the most interesting presented at this Branch.

Sarnia

S. V. Antenbring, M.E.I.C.,
Secretary-Treasurer

Dennis P. Herring, M.E.I.C.,
Branch News Editor

Annual Meeting

The annual meeting of the Sarnia Branch was held at the Sarnia Riding Club, with Chairman C. P. Sturdee presiding.

Engineering publicity again came up for critical evaluation and it was generally agreed that a diplomatic enlightenment of the press together with proper selling was very necessary. Mention was made of a general professional salary survey (engineers included) published recently. Ambiguity was introduced due to the fact that all the engineers so noted were consultants, not employees, thus producing a very unrealistic salary picture. As selling the engineering profession to the general public is abetted by engineers taking an active part in public office, it was noted with approval that both Mr. B. H. MacKenzie and Mr. D. P. Herring had been elected to the Hydro Electric Commission.

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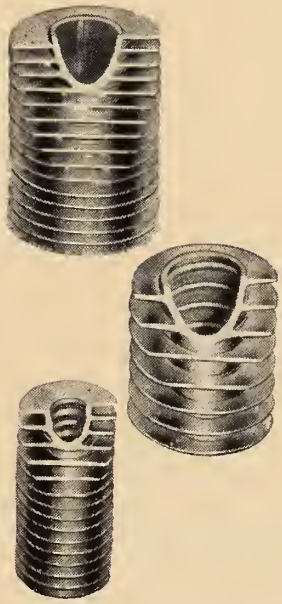

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subject of group classifications in the E.I.C., the feeling of some members being that the present senior classification (Member) provided no more tangible, positive benefits than that of Junior. While it was agreed that there is a certain degree of honour attached to the senior grouping, nevertheless, to the practically minded there was also a financial penalty to consider by way of increased fee. One suggestion was to make the fee identical for junior and member, member standing being only attained when a certain rank or authority was reached. This would tend to make the "Member" a man to be respected due to his personal attainments and not to an automatic transfer at the end of a period of years. Naturally this question requires very careful consideration as this approach would, of necessity, have to receive the wholehearted acceptance of the engineering body — either by proper selling of the idea or by its obvious benefits. We must not lose sight of the fact that only by its popular appeal to the engineering body will the E.I.C. maintain and expand its membership. Any dictates which are evolved must very apparently improve the status of the profession and increase the attractiveness of the association.

Commenting on the E.I.C. Junior Development Course which is being tried experimentally in a few centres, the Sarnia offering has been very enthusiastically received. Quite a number of Members have also evinced interest.

Councillor Mr. F. F. Dyer commented briefly on council activities and also shed explanation on the factors behind Dr. Wright's European tour interviewing prospective immigrant engineers. One expression of opinion was that the engineering profession should have more voice in the importation of foreign engineers and the national formulation of engineering policy. Another idea presented was that perhaps the engineering shortage was one of a lack of cheap engineers rather than engineers generally. It was pointed out that while the Canadian demand appeared to be for recent graduates, foreign engineers generally were proving to be men of quite considerable experience and while they were able to obtain employment, were not able to do so at the senior level which they might normally expect.

The results of the election for the 1952 slate of officers were announced. Mr. J. W. Graeb is chairman by acclamation. Other officers are G. R. McMillin, vice-chairman; S. B. Antenbring, secretary; D. S. McArthur, treasurer; J. J. Rowan, programme chairman; W. D. Suitor, house chairman; J. E. Kelough, membership; D. P. Herring, publicity; R. E. LeSueur, chairman, junior section and special projects committee. Remaining on the executive in his capacity of past president is C. P. Sturdee. F. F. Dyer also will remain on the executive through his office as councillor.

Mr. B. H. Mackenzie, also elected to the executive, was unable to take office because of a transfer out of the city.

The evening was rounded off with a tasty buffet luncheon.

Dinner Meeting

The first dinner meeting of the Sarnia Branch for 1952 was held in the Lutheran Church Hall.

After dinner and a short interlude of business, the guest speaker, Dr. E. J. Buckler, manager of the research and development division of Polymer Cor-

poration, Sarnia, delivered an address on the evolution of synthetic rubber. The talk, supported by graphs and charts, samples and tests, related the history of research in rubber from the time over 125 years ago, when Michael Faraday first studied the decomposition of natural rubber by heat.

During the last century it was the curiosity of the chemist to determine the structure of these remarkable substances which, under proper treatment, develop strength equivalent to their weight of steel and twenty times its abrasion resistance, and have the greatest capacity of any known material for absorbing mechanical shock and stresses.

In the early years of the century the automobile was invented, and created a demand, which is still increasing at the present time. It was responsible for the first violent increase in the price of natural rubber, which in 1910 reached $3.00 per lb. and spurred industry to seek synthetic substitutes.

A second violent increase to $1.00 per lb. occurred in 1925 due to restriction of output under the Stevenson plan, which stimulated a second wave of intensive research. In 1928 the German chemists of I. G. Farben evolved the butadiene-styrene rubbers by processes which served them well during the second World War and formed the basis of the GR-S rubbers later made in Canada and the United States. The first special-purpose rubbers also appeared; the oil resistant Perbunan in Germnay, the flame-resistant Neoprene by Dupont, and Butyl, the inner tube rubber, by Standard Oil Development Company.

After the war and up to the present time there has been a period of systematic application of scientific methods in the U.S. and Canada to reduce manufacturing cost and improve quality. The difficult task has been virtually completed of elucidating the structure of the GR-S type. Extension of the original German laboratory work, especially by the Phillips Petroleum Company, led to the use of lower temperatures for synthesizing the rubber, which changed the structure to approximate more closely to that of natural rubber. This resulted in an improvement of 20% or more in tire tread wear and other properties. Now the proportion of synthetic rubber produced by the "cold" process is 50% and will be 75% by the end of this year.

The next significant advance was made in 1950 by General Tire and Polymer Corporation in adapting the low-temperature process to produce an extremely high quality rubber which, although too tough to be handled by itself in the rubber factory, could accommodate up to half its own weight of inexpensive petroleum oils, to yield a product which could be processed and yet still possessed a balance of quality over ordinary "cold" rubber. This step makes possible significant increase in synthetic rubber production from the available critical raw materials and opens up new possibilities of tailor-making rubbers for special purposes.

It would appear that, as in the case of many other products, a trend has been established in which the natural product is rising in price, while the synthetic substitute is continually being improved in quality and, in relation to other materials, reduced in price. It is not expected or hoped that the general-purpose synthetic rubbers will completely displace the natural product within this generation, but it is predicted that

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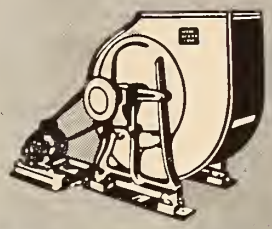
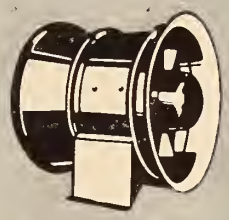
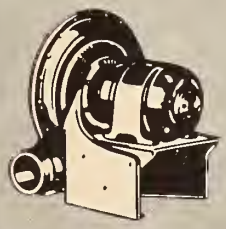


Limit-Load Ventilating Fan



Axial Flow Fan

Volume Fan



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the further growth in world demand for rubber will be met largely by the synthetic rubber producers. In addition, there will be an increasing number of applications in which specially-designed synthetic rubbers will be superior to the natural product.

Sudbury

W. S. Black, M.E.I.C.,
Secretary-Treasurer

A. D. Finlayson, Jr.E.I.C.,
Branch News Editor

Joint Meeting

The annual joint dinner meeting of the Sudbury Branch of the Institute and local members of the Association of Professional Engineers of Ontario was held on February 7, 1952. The meeting was addressed by Mr. O. D. Johnston, president of the Association.

The speaker was introduced by Mr. J. R. Gill, chief engineer of Falconbridge Nickel Mines Ltd., who outlined the outstanding career of Mr. Johnston who is president of Gooderham & Worts Ltd.

Mr. Johnston outlined the increasing activities of the Association of Professional Engineers in the past few years. With the doubling of membership during this period the work of the existing committees has increased greatly. It has been necessary for the Examination Committee to investigate the courses of most of the technical institutes of Europe as well as other parts of the world in order to deal with the applications for admission of immigrant engineers to the association. Future applications can be dealt with more easily with the help of the file which has been compiled on these institutions.

The Public Relations Committee has increased its efforts to bring the achievements of professional engineers to the notice of the public. Their work together with that of the publicity agency which the association has hired has resulted in an increasing number of news items appearing in newspapers and magazines.

Though they are doing a fine job, in Mr. Johnston's opinion, professional engineers must increase their personal activities in community affairs. Only in this manner will the profession gain proper recognition.

Mr. Johnston encouraged all present to read the inaugural address of Mr. Carlton S. Proctor, president of the A.S.C.E. in the January 1952 issue of *The Engineering Journal,* which called on engineers to defend competitive economy and industrial initiative.

A vote of thanks to the speaker was moved by Mr. Frank Orange.

Col. T. M. Medland in his turn to speak offered to answer any questions on the activities of the Association rather than deal with any particular subject. Among the numerous questions asked of Col. Medland were included enquiries on the new headquarters building, the present supply of engineers and what steps are being taken to encourage students to enter the profession.

The chairman of the meeting Mr. Bob Moore announced that a request from the Sudbury organizer of Civil Defence had been received for three engineers to act on the Civil Defence Committee.

Toronto

W. C. Watt, M.E.I.C.,
Secretary-Treasurer

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

February Meeting

A well attended meeting of the Toronto Branch was held at the Walberg Building, University of Toronto, on February 21, 1952. The speaker was Mr. E. F. Tabisz, general manager, Underwriters' Laboratories of Canada, Toronto, Ontario. The title of Mr. Tabisz speech was **Another Step Towards Canadian Self-Sufficiency.** He pointed out that Canadian industry is expanding at a rapid rate and that new and novel manufacturing processes embodying serious potential hazards are being introduced. He also pointed out that there is much greater use of mechanical and electric devices than ever before, also that new synthetic materials are being announced almost daily, all with a view towards improving methods of processing commonly known products such as wood, paper, and textiles are being developed.

All these advancements have ushered in a greatly increased risk of fire and accident. Information to help stop fires before they start and to prevent accidents is an urgent need Mr. Tabisz said. He also advised that the capital stock

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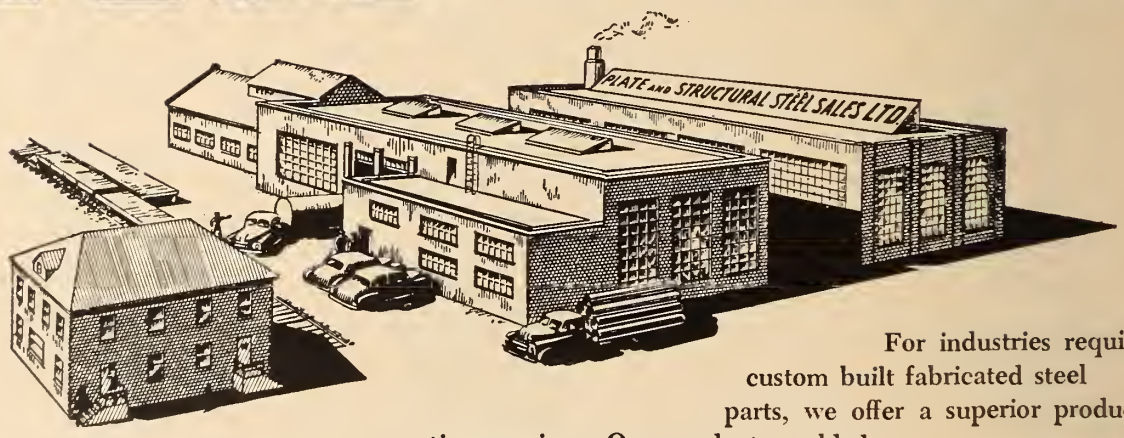

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fire insurance companies of Canada are recognizing this need and are in the process of setting up a testing laboratory, the purpose of which is to improve the safety of Canadian citizens and to help protect the natural and created wealth of Canada.

The members and visitors attending showed a great deal of interest in the paper which was supplemented with a sound film entitled "Approved by the Underwriters".

The meeting was opened by the chairman, Mr. W. H. Patterson who introduced Mr. Tabisz, and at the end of his paper, Mr. Jack Wilson of the Junior Section very ably expressed a vote of thanks to the speaker.

Annual Students Night, February

Students Night was held on February 7, 1952, in the Debates Room at Hart House, University of Toronto.

The following students competed for the three cash prizes made available by donations from various firms: M. A. Harrison, J. Lawrence, L. R. Nash, R. J. S. Sherk, R. Stevenson.

The following gentlemen, with Miss Elsie MacGill, acted as the judges: Professor T. R. Loudon, and Mr. Clare Carruthers.

E. F. Tabisz

Mr. W. A. Paterson, chairman of the branch, presided, and after opening the meeting, handed it over to Dean Tupper of the University of Toronto, who in turn introduced the various students.

L. R. Nash, in presenting his paper on **Solar Heating,** dealt to some extent on residential applications, and clearly indicated that he had a very good grasp of the subject, resulting in the judges awarding him the first prize of $50.00.

M. A. Harrison's paper on the **Electronic Computer Memory** was well presented; and after the judges retired for deliberation, several interesting questions were asked by several members of the meeting. Mr. Harrison answered them in a most humorous, but able manner.

Mr. J. Lawrence presented his paper on **Non Metallic Bearings** by exhibiting numerous samples of the actual materials and he, like the others, showed a keen knowledge as to the proper uses of Non Metallic Bearings, at the same time pointing out their disadvantages.

The judges evidently had difficulty in coming to a conclusion as to the second prize award, and settled by combining the second and third, and awarding M. A. Harrison and J. Lawrence the second prize of $25.00 each.

Mr. Sherk's paper on **Explosives** was very interesting and is worth mentioning. All the above mentioned were 4th year students.

R. Stevenson's paper on **Maintenance** covered the main items to be observed in this branch of the profession; and as a third year student, he did very well.

While the judges were considering the papers, a film was shown entitled "Rail Steel in the World of Today", and after the judges delivered the results, a social half hour was spent with coffee and doughnuts in the Great Hall at Hart House.

Junior Section

Morris E. Misener, Jr.E.I.C.,
Secretary-Treasurer

January Meeting

January 30, in the Debates Room of Hart House was the occasion of an interesting and informative informal discussion of The Architect vs. The Engineer.

The respective views were aptly presented by Messrs. W. E. Fleury, of Fleury and Arthur, architects, and Edgar A. Cross, consulting engineer.

The procedure was for each to speak approximately fifteen minutes, beginning with Mr. Fleury. This was followed by an informal discussion between the speakers only, with the audience temporarily curbing their questions. There then followed a lively discussion period with questions and comments from the floor.

The speakers outlined and discussed the field of work of each branch of science and the resulting natural qualifications and training required of the men in each. The borderline, overlapping cases were also discussed and shown to be the exception rather than the rule. It is believed that everyone present went home somewhat more informed as to architects and their work and realizing that they as well as engineers play an important role in our daily lives.

Adjournment of the meeting was followed by refreshments in the form of coffee and doughnuts. These were served in the Great Hall which afforded an excellent opportunity for the members to renew acquaintances and make new ones or continue their discussions if they so desired.

Winnipeg

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

Electrical Section

J. G. Dickinson, Jr.E.I.C.,
News Editor

Annual Meeting

The annual meeting of the Electrical Section of the Winnipeg Branch was held last January 10th, in a room of the new United College Building. Mr. Ernie Scott was elected Chairman for the next term, Mr. Bob Tivy, vice chairman, and Professor Nev. Williams, Branch delegate.

Following the short business meeting,

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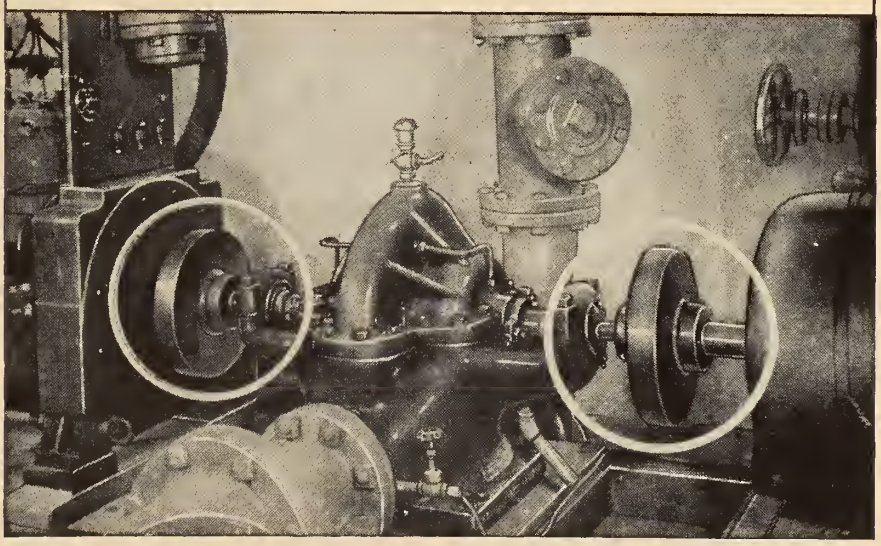

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Mr. D. J. Watson of the Communications Equipment Division, Northern Electric Company Limited, Montreal, presented a most interesting paper on the new electronic amplifier which will eventually replace the radio tube in many applications.

This new device is an invention of the Bell Telephone Laboratories, New York, and is called a **Transistor.** This tiny amplifier is about the size of a small garden pea and with the three fine wires which are attached to it runs about five hundred to the pound. Although it is presently being used only in military and telephone applications, the Transistor will have many other applications in the electronics field. It is rugged in construction, uses only minute quantities of power and has a life expectancy many times that of present vacuum tubes. Another interesting feature of this device is that it requires no "heating up" time such as is necessary for vacuum tubes.

The heart of the Transistor is a tiny crystal of silvery grey material called Germanium, which belongs to a group of metals known technically as semi-conductors. This crystal is enclosed in a plastic bead; connections to the crystal being made by three fine wires extending through the bead.

At the conclusion of his talk, Mr. Watson gave a demonstration of the Transistor at work as an oscillator and and as an amplifier. This was demonstrated by means of a miniature electric organ which used only two Transistors, but could be heard clearly throughout the hall.

It is worthwhile noting that this revolutionary development, like many others, was made possible by scientists and engineers working under the auspices of private enterprise. It seems too few people realize sometimes the tremendous amount of money and energy which is spent by enterpreneurs in the development of equipment and resources that eventually benefit many companies and every person.

Winnipeg Branch, Electrical Section. Chairman E. Scott and Mr. D. J. Watson, the speaker at the meeting of January 10.

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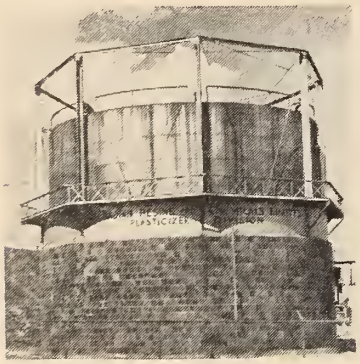

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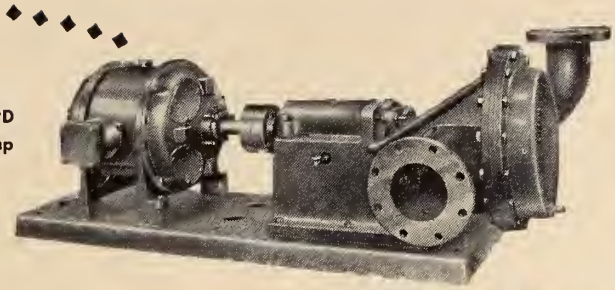
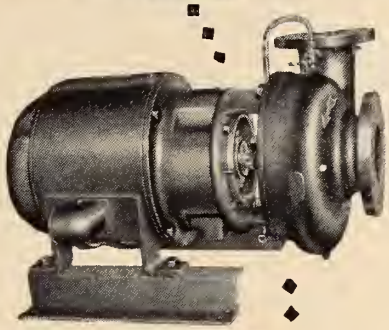


Type SSPD process pump



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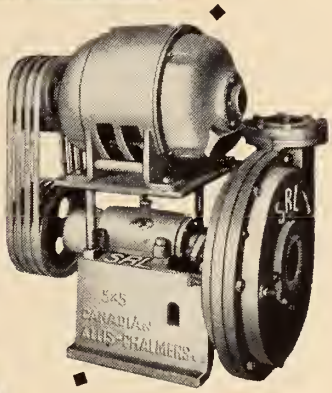
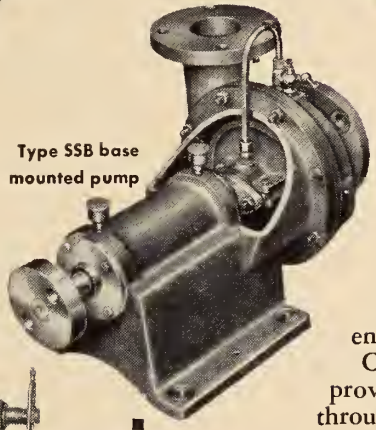


Type SRL rubber lined pump



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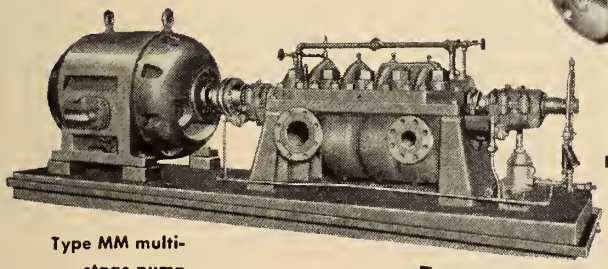
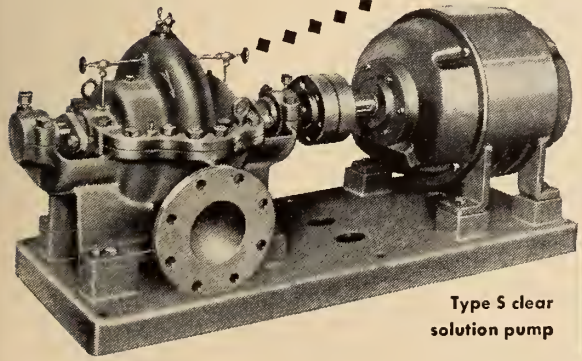


Type MM multi-stage pump



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BOOK REVIEW

Work of Oscar Niemeyer. Stamo Papadaki. New York, Reinhold, c1950. 220 pp., illus., $9.00.

Oscar Niemeyer, a brilliant young architect from Brazil, first made a name for himself with his design for the Brazilian pavilion at the 1939 New York World's Fair, and later as a design consultant for the United Nations building in New York.

A study of the photographic illustrations, which form the bulk of the volume, leave one with the feeling that the creator has produced originality of design for a variety of types of buildings through the adaptation of basic line to particular locale and requirements.

Perhaps this observation should be enlarged. Consider for illustration, the Rio de Janeiro day nursery. Six-foot high vertical adjustable sunshades, made of sheets of asbestos cement one foot wide, pivoted on metal frames, and adjustable from the inside, form the whole of one side of the building. This arrangement provides a maximum of light and air, while cutting off the heat from the sun's rays.

Again, in the Boavista Bank in Rio de Janeiro, two-storey high glass block walls are constructed in an undulating form, which provides better interior arrangement of furniture, more stability, and richer light effects. The finished product is both pleasing and gracious, while still maintaining a business-like atmosphere.

From the third storey up, sunshades are of both vertical and horizontal louvers, depending on the exposure of the wall. These louvers are painted, from almost white on the lower floors, so as to reflect light in the offices, to deep blue on the upper floors for light absorption. These colours are so calculated that they all appear the same colour from the street.

Schools, churches, office buildings, theatres, clubs, and even monuments, are included in this versatile architect's repertoire, samples of all of the above being included in this volume. Rough sketches, final plans, and photographs of the completed structures, all combine to produce an excellent over-all picture of Niemeyer's work.

While in a great deal of so called modern, or modernistic architecture, one is conscious of utility, one is so often also too conscious of a desire on the part of the architect for the bizarre.

Obviously, an admirer and follower of Le Corbusier, Niemeyer has created a pleasing and original combination of beauty of line and utility, which many of the more spectacularly minded members of the profession would do well to emulate.

E.K.

LIBRARY REGULATIONS

Hours

Mon., Tues., Wed., Fri. . 9 a.m. - 6 p.m.
Thursdays . . . . . 9 a.m. - 8 p.m.
(For Montreal branch meetings)
Saturdays . . . . 9 a.m. to 12 noon

Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

Please give as much detail as possible when requesting information of either type.

Borrowing and Purchasing

Books, periodicals, photostats, translation, etc. may be borrowed for two weeks at a time. **A fine of 25c. per day will be charged for each day borrowed items are retained beyond this period.**

A library deposit of $5.00 at par in Montreal is required for which two items may be borrowed at one time. Books, periodicals, etc. may be ordered by members through the library. All carrying charges are payable by the individual concerned. Except in the case of library deposits, please make **no payments in advance.**

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

BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

Barrages en terre. Ch. Mallet and J. Pacquant. Paris, Eyrolles, 1951. 345 pp., illus., 2,500 fr.

This volume is concerned with the present practice in the design and construction of earth dams. It is without precedent in modern French engineering and will give to the reader a good idea of the trends in dam construction on French territory. After a chapter on generalities, the authors deal at length with flood evaluation methods. The third chapter, on infiltrations, is illustrated with a great many theoretical examples, while the fourth gives information on protection works. The last two chapters deal with stability calculations and construction methods. The reader will find in this book a survey of the difficulties generally encountered in the construction of earth dams and of the methods used in the tackling and solving of these problems.

Béton précontraint: étude théorique et expérimentale. Y. Guyon. Paris, Eyrolles, 1951. 702 pp., illus., 4,500 fr.

It is the author's claim that there is no construction problem to which prestressing cannot give a solution. Although the applications of the principle are innumerable (pipes, beams, foundations, dams, etc.) this theoretical and experimental study of prestressed concrete is concerned solely with the case of the straight plane beam resting on two supports. Of the three parts of this volume, the first deals with the straight beam as a general problem, the second deals with the calculations pertaining to its elasticity, and the third with trials and security. It is illustrated with many diagrams and a few photographs. A second volume will eventually be published.

Business Executive's Handbook, 3rd ed. S. M. Brown, ed. New York, Prentice [1951] 1,600 pp., $9.00.

Although this volume is entitled "Business Executive's Handbook", it should certainly be made available to the executive's secretary, and to many other people about the office.

Basic, rather than specific, business problems are considered, such as business mathematics, including computing of interest, etc.; all types of business letters, including forms, contracts etc.; various forms of advertising, and direct mail sales, and postal information (American only); and finally the more executive type of information on corporation meetings, partnerships, directors, and the like.

The general table of contents at the front lists all the sections, and their page number. In addition to this, which is a great convenience for speedy reference, a detailed table of contents precedes each section. An alphabetical index at the back adds further to the book's usefulness.

Many of our members would find this a valuable addition to their office book shelf.

Engineering Profession, 2nd ed. T. J. Hoover and J. C. Fish. Stanford, California, Stanford University Press, c1950. 486 pp., $7.50.

The qualifications, duties and frame of mind of the professional engineer are discussed at length in this detailed analysis. For each of the main branches of engineering (civil, mining, mechanical, electrical, chemical, agricultural, archi-

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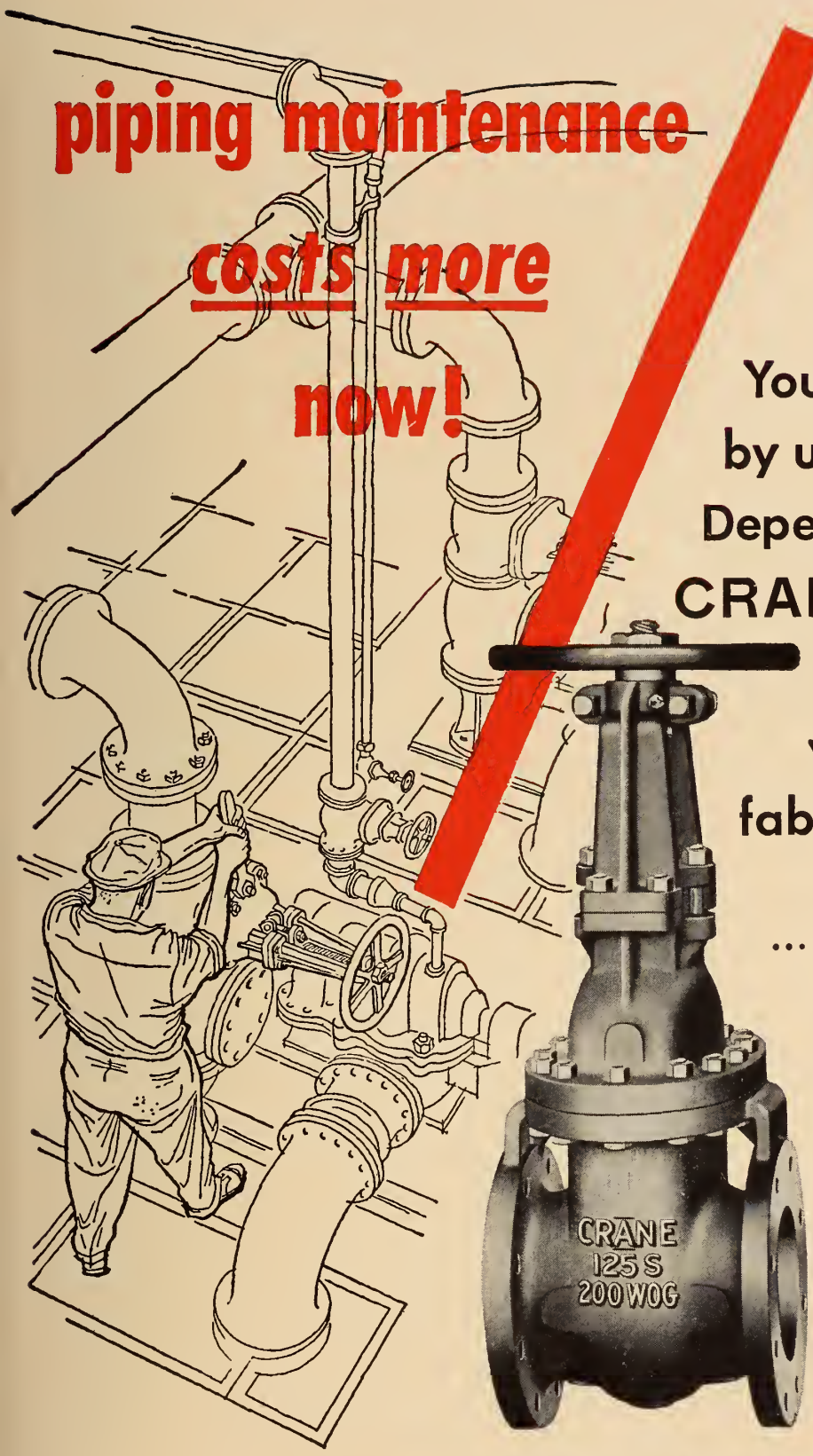

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tectural and acoustical) the following problems are discussed: what are the subfields, what will be the functions of the engineer, who will be his employers, who will he supervise, what positions will he hold immediately after graduation, where will he spend his working hours, what are the disadvantages and hazards, how good is the remuneration, and what is the employment outlook? Other chapters deal with engineering problems of less immediate import to the young engineer, such as: who is an engineer, what is engineering, the method in engineering, and engineering education. This book will serve as an excellent vocational guide for the young man, while such an analysis of his profession will make interesting reading for the experienced engineer.

International Glossary of Technical Terms Used in Housing and Town Planning, 2nd ed. H. J. Spinak, ed. The Hague, International federation for housing and town planning, c1951. 144 pp., $3.50.

Properly titled an International Glossary, this volume has been prepared, and now revised in a second edition, to be a handbook and guide for the members of the International Federation for housing and town planning. It differs fundamentally from an ordinary inter-lingual dictionary, in that it includes only terms whose equivalents or meanings for the precise use of the building trade, are not easily ascertainable in an ordinary dictionary.

English, French, German, Italian, and Spanish are the five languages used in this second edition, and full directions are given as to its proper use in all languages.

Interpretation of X-Ray Diffraction Photographs. N. F. M. Henry and others. Toronto, Macmillan, 1951. 258 pp., illus., $8.20.

The study of crystalline matter by means of X-rays has developed rapidly in the last twenty years and has become of great importance in chemistry, physics, metallurgy and mineralogy. The primary purpose of this book is to help students and research workers to understand the theory and practice of the interpretation of X-ray diffraction photographs. Although ionisation-spectrometer methods are discussed as auxiliary techniques, it is with photographic methods that the book is essentially concerned. Discussion is confined to the study of the crystalline state proper; the liquid and semi-crystalline states are not touched upon. Much of the material is presented in a geometrical way, as it has been found that this is the most suitable method of teaching crystallography. A sufficient number of tables has been included to facilitate calculations without the necessity of a reference book.

Introduction to Acoustics. R. H. Randall. Cambridge, Mass., Addison-Wesley, 1951. 340 pp., illus., $7.50.

The present work is intended for the student who has completed a general course in physics. It aims at striking a happy medium between elementary books and the reference books of the engineering or graduate level. Apart from the expected chapters on vibration, plane waves, three-dimension waves, interference, etc., the author has included a chapter on applied features of his subject, such as the physics of musical instruments, peculiarities of hearing, the design of radio loudspeakers, and acoustics of auditoriums. A year of college physics and a year of calculus constitute a minimum preparation for the subject as presented here. Engineering students who may later wish to specialize in communications and electroacoustics, will find this book very useful.

Metallic and Non-Metallic Coatings for Gray Iron. C. O. Burgess. Cleveland, Gray Iron Founders' Society, c1950. $1.75.

Welding, Joining and Cutting of Gray Iron. C. O. Burgess. Cleveland, Gray Iron Founders' Society, c1950. $1.50.

The first of these publications is devoted to a discussion of metallic and non-metallic coatings that have been successfully applied to gray iron on a commercial scale. The methods of applying coatings include spraying, brushing, welding, cementation, dipping, chemical conversion, or electroplating. An excellent bibliography will lead the reader to more detailed operational information.

The second publication demonstrates that gray iron and gray iron castings can be successfully welded if certain simple but essential practices are employed. It is divided into chapters on gas welding, arc welding, brazing, special joining processes, and, finally, torch and arc cutting. An excellent bibliography is also included. In both these booklets, numerous photographs provide an almost step-by-step explanation of processes.

National Directory of the Canadian Pulp and Paper Industries. J. N. Stephenson, ed. Gardenvale, National business publications, 1951. 474 pp., $3.00.

This 1951 edition has been prepared from available statistics on the industry and its branches. Information on the manufacturers and distributors of pulp, paper and board has been obtained directly from original sources up to the end of September. The reader will find a listing of the various pulp and paper companies by towns. Also included are tables showing the number of pulp, paper and integrated mills by kinds, as well as the number of grinders, the number of machines and the number of digesters by kinds, location and capacity. For each company the following information is given: head office address, branch office address, cable address, mills addresses, railway connections, officers, directors, capitalization. The general superintendent, equipment, sources of power, and production are given for each mill of each company. Timber supply is given whenever available, and a very useful addition is the listing of Canadian Trade Commissioners, Foreign Consulates and commercial representatives, and Lands and Forests Ministries in Canada.

Proceedings of the Seventh Annual Forum of the American Helicopter Society in co-operation with the Institute of the Aeronautical Sciences, April 26-28, 1951. New York, Institute of the Aeronautical Sciences, 1951. 159 pp., illus., $5.50 [mimeographed]

These proceedings are divided into three sections. A section on theory and design contains articles on rotor performance possibilities, the characteristics of the rotors, the service life of the rotors, the design of a rotor kite, and the adaptation of jets to helicopters. A section on development and test contains articles on testing, towing, regulations and test procedures, and transmission testing. A section on economics contains articles on the Liverpool-Cardiff helicopter service, transport helicopters, and economic and logistic aspects of military operation. Two symposia on commercial and military operations are included, along with diagram, graph, map, and figure illustrations.

Receiving Tube Substitution Guide Book, first supplement. H. A. Middleton. New York, Rider, c1951. 44 pp., illus., 99 cents.

There are about 750 new substitutions listed in this supplement, most of these being for television receivers. This guide is very useful when the original tubes needed to repair electronic equipment, are not available. In addition to being of assistance during times of tube shortages, this information helps to make use of tubes which have been on hand for some time.

Tensor Analysis: Theory and Applications. I. S. Sokolnikoff. New York, Wiley, 1951. 335 pp., illus., $7.50.

Because of the importance of linear transformations in motivating the development of tensor theory, the first chapter is concerned with a discussion of the geometry and physics of linear transformations and matrices. The second chapter deals with algebra and calculus of tensors. It is self-contained and does not depend on some special field of mathematics as a vehicle for the development of tensor analysis. Chapter three contains a selection of those geometrical topics that are important in the study of analytical dynamics and in such aspects of elasticity and plasticity as deal with the deformation of plates and shells. Chapter four covers the essential concepts of analytical mechanics while chapter five contains an introduction to relativistic mechanics.

Transients in Power Systems. H. A. Peterson. New York, Wiley, 1951. 361 pp., illus., $6.50.

This book is written primarily for engineers engaged in power system and apparatus design. It is written secondarily for engineering students who may wish to use it as a reference book for advanced study in electric circuit phenomena. It is not the author's intention to emphasize the rigorous mathematical circuit-theory approach, but rather, through the discussion of results, to reach conclusions of value to the designer. During the past decade, the development of new tools, such as the differential analyser and the transient analyser, has resulted in the publication of much recent technical literature. It is largely the object of this book to organize and consolidate information either scattered about in these numerous publications, or never published before.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Building Estimator's Reference Book. F. R. Walker, 11th ed. Chicago, Frank R. Walker Company, 1950. 1,780 pp., illus., $15.00.

Vest-Pocket Estimator, F. R. Walker. 220 pp., illus., included with **Building Estimator's Reference Book,** not sold separately.

This standard reference manual provides comprehensive information and detailed cost figures for the estimating of all classes of modern buildings. The full range of construction work is covered from foundations to interior equipment and wiring. This latest edition is completely revised, rewritten and reset with obsolete matter deleted and much new material added.

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The pocket-sized book contains in tabular form material quantities and labour hours for estimating the cost of all classes of building construction.

Internal Constitution of the Earth. Edited by Beno Gutenberg, Director, Seismological Laboratory, California Institute of Technology, second edition. New York, Dover, c1951. 439 pp., $6.00.

Originally published as Vol. VII in the National Research Council's "Physics of the Earth" series, this comprehensive reference work has been completely revised and brought up-to-date. Eleven authorities have contributed chapters dealing with all aspects of the nature and development of the earth's crust and interior core. Special characteristics and methods for their determination are covered. The detailed information is of value to geologists, mining and petroleum engineers, seismologists, etc.

Mechanics Applied to Vibrations and Balancing. D. L. Thornton, 2nd ed. London, Chapman; Toronto, British Book Service, 1951. 584 pp., illus., $10.00.

Written for engineers and physicists, this book presents the general theory of vibrations in its various aspects. This second edition contains a re-written general survey and a new chapter dealing with the transmission of stress under conditions of rapidly applied loading, such as are encountered in the design of fortifications and structures to withstand the effects of explosions. Includes chapters on balancing of engines and locomotives, propagation of stress in elastic materials, beams and plates, rotating shafts and discs, and dynamic loading of structures.

Modern Pyrometry. C. H. Campbell. New York, Chemical Publishing Company, 1951. 150 pp., illus., $4.80.

In covering the field this book deals with the relatively common as well as the new techniques in pyrometric practice and equipment. It describes in detail the construction and operation of selected types of apparatus including indicating, recording, and controlling devices, and also covers the care and maintenance of pyrometers.

Non-Destructive Testing of Metals. R. F. Hanstock. London, The Institute of Metals (Monograph and Report Series No. 10), 1951. 163 pp., illus., $3.50.

In this monograph consideration is given not only to the well-known radiographic, magnetic, and ultrasonic methods but also to other available methods of examination with the object of providing a reference work giving alternative approaches to special problems. To this end the limitations are carefully indicated within which a test may be expected to operate successfully. Test classifications dealt with are thickness measurements, surface finish, defect detection, composition analysis, mechanical properties, and physical state.

Punched Cards, their Applications to Science and Industry. Edited by R. S. Casey and J. W. Perry. New York, Reinhold, 1951. 506 pp., illus., $10.00.

The primary purpose of this book is to furnish sufficient information to the individual engineer, scientist or technologist so that he may apply punched-card techniques to individual problems. The five parts of the book are: punched-card fundamentals; case histories of punched-card applications; general and fundamental considerations; future possibilities of applying mechanized methods to scientific and technical literature; and a bibliography on uses of punched cards.

TV and Electronics as a Career. Ira Kamen and R. H. Dorf. New York, Rider, 1951. 326 pp., $4.95.

The authors first describe the detailed workings of each phase of the industry—broadcasting, manufacturing, engineering, sales, etc. — followed by the story of how each individual contributes to the over-all operation, how much he is paid, how to get the job, the training needed, and the future outlook. A chapter is devoted to the opportunities for electronic technicians in the armed services.

STANDARDS

British Standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W.1. British Standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 108: 1951 — Graphical Symbols for General Electrical Purposes. 10/6.

This standard covers graphical symbols relating mainly to power and lighting applications. It includes general symbols and detailed symbols, relating to generating and converting plant, conductors, machines, rectifiers, transformers, switchgear, resistors, surge divertors, fuses, relays, lamps, electric clocks, traction, and location symbols for installations.

B.S. 970: 1951, Addendum No. 1 — Emergency Specifications for Case Hardening Steels. 1/–.

This addendum to B.S. 970 contains eight specifications designated En. 351, 352, 353, 354, 355, 361, 362 and 363 covering case hardening steels.

B.S. 1750: 1952 — Bolting for the Petroleum Industry. 6/–.

This standard is divided into three parts as follows: 1. Alloy steel stud-bolts, studs, bolts and screws for high pressure and high temperature service; 2. Carbon and alloy steel nuts for high pressure and high temperature service; 3. Carbon steel bolts, stud-bolts, studs and nuts for moderate duty service. Each part contains details of material, heat treatment, screw threads, dimensions, finish, marking and methods of test. The document provides for screw threads in accordance with both B.S. 1580, "Unified screw threads" and B.S. 84, "Screw threads of Whitworth form".

B.S. 1798: 1951 — Symbols, Terms and Definitions for Gas Quantities in Reciprocating Internal Combustion Engines. 1/6.

The standard applies to two-stroke cycle and four-stroke cycle engines, atmospherically charged and pressure-charged, and also to free piston engines. Symbols, terms and definitions are given for the simple quantities from which such functions as the above are derived. By means of the symbols, commonly used expressions can be clearly defined. Moreover, many other relationships can be simply expressed, whereas the allocation of names to them all is impracticable.

B.S. 1800: 1951 — Methods for the Analysis of Raw Copper. 5/–.

This document includes methods of analysis (sampling, apparatus, reagents and procedures) for the elements (except oxygen) concerning which definite limits are specified in B.S. 1035-40, "Raw copper", and B.S. 1172-4, "Deoxidized and arsenical coppers". A method for the determination of sulphur content is also included, although limits are not specified in the above standards.

B.S. 1802: 1951 — Steel Spring Washers for General Engineering and Automobile Purposes. 2/–.

The present work does not apply to "lock" washers. Although the emphasis is on dimensions, clauses on suitable material, heat treatment, hardness testing and related manufacturing items are included. The provisions are not intended to apply to washers used by the aircraft industry. The range of sizes will suffice for general industrial use and will limit the number of different sectional sizes which the manufacturers are required to stock.

B.S. 537: 1951 — Lancashire and Cornish Boilers of Riveted Construction. B.S. 609: 1951 — Horizontal Multitubular Boilers of Riveted Construction. B.S. 665: 1951— Vertical Cross Tube Boilers of Riveted Construction. B.S. 761: 1951 — Vertical Multitubular Boilers of Riveted Construction. B.S. 931: 1951 — Loco-type Multitubular Boilers of Riveted Construction. 6/– each.

The original editions of these standards have been extensively revised. The terms "maximum permissible working pressure" and "safety valve blow-off pressure" in the Factories Act 1937 - 1948, have been deleted and replaced by the term "design pressure".

These standards deal with materials, construction, workmanship, scantlings, inspection and testing of the boilers. The formulae in the sections dealing with scantlings give in all cases the minimum scantlings and apply to boilers constructed under constant competent supervision. Typical methods of attachment of stand-pipes and pads secured by welding alone are given in an appendix to each of these standards.

B.S. SP. 33-39: 1951 — Turnbarrels, Tension Rods and Swaged Cable-end Connections for Aircraft. 2/6.

This series comprises the following seven standards: "Turnbarrels", "Screwed ends", "Tension rods", "Tapped ends", "Eye ends", "Fork ends" and "Eye ends for chain". These standards detail a tensioning device for aircraft control cables and variable range of cable-end fittings as a safeguard against the crossing of controls. The turnbarrel and tension rods are designed to connect screwed end and tapped end fittings respectively: these in turn are swaged to cables.

B.S. SP. 41-46: 1951 — Tab Washers for Aircraft. 1/–.

Herein the reader will find specifications on the materials, dimensions and finish of mild steel and non-corrodible steel straight, right angle and left angle tab washers for aircraft. An appendix to the specifications gives details of a recommended method of application when washers are fitted into drilled holes.

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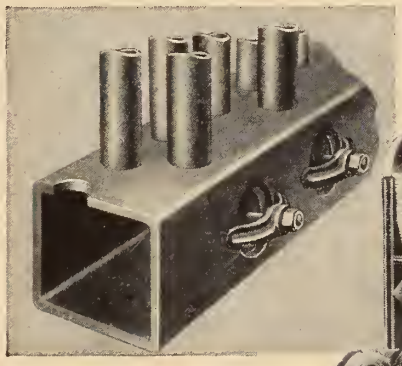

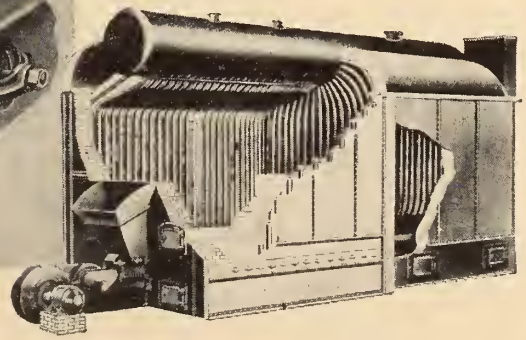

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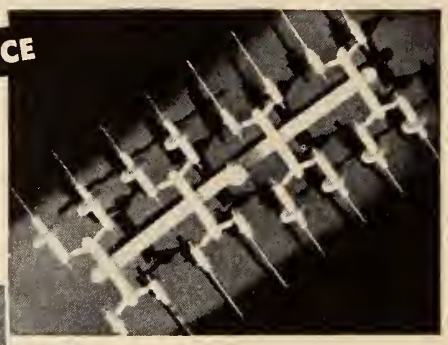

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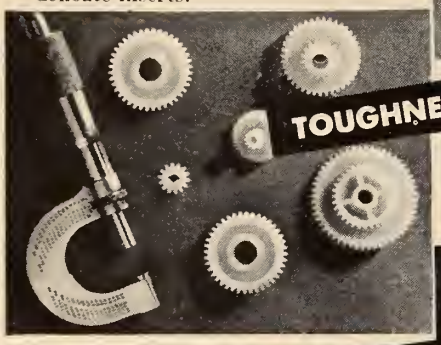

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B.S. CP. 1004, Part 1: 1952 — Code of Practice for Street Lighting, Part 1: Traffic Routes. 4/–.

This code of practice explains what allowances should be made, when the lighting of a given road is planned. Volume and type of traffic, layout and nature of the road and its surface, boundary conditions etc., are considered, in order that the required level of lighting expressed in lumens per linear foot of route may be secured. The use of either electricity or gas is envisaged.

B.S. Handbook No. 13: 1951 — Mechanical Tests for Metals. 17/6.

The British standards dealing solely with mechanical testing, and extracts from other standards to illustrate particular applications of the tests have been collected under this cover. This reference book will be useful to industry and to universities and technical colleges where the subject of "Strength of materials" is taught. It has been arranged in sections dealing with types of tests: seven sections cover tensile tests, hardness tests, impact tests, ductility tests, the transverse tests for cast iron and the verification of tensile and compression testing machines.

Canadian Government Specifications Board, Schedules. Canadian Government Specifications Board, National Research Council, Ottawa.

1 - GP - 12a — Schedule of Standard Paint Colours. $2.00.

In this standard, a new numbering system has been adopted which groups the colours in ten broad divisions. The colours are numbered on the decimal system. Although no semi-gloss colours are included in this edition of the schedule, the colour numbering system permits the classification of the colours into the categories of gloss, semi-gloss and flat. A 2 in. by 3 in. colour chip is included for each colour. The whole book is divided into "gloss" and "flat", these divisions being subdivised in grey, blue, green, brown, yellow, cream, buff, orange, red, and miscellaneous. These subdivisions are further subdivided into many shades illustrated by the colour chips. Tables of concordance with the 1944 edition and the British Standards are also given.

Canadian Standards. Canadian Standards Association, National Research Building, Ottawa.

CSA. B29: 1951 — Established Lists of Machine Screws, Stove Bolts, Machine Screw and Stove Bolt Nuts, 4th ed. $1.00.

The opportunity has been taken to calculate the values of the thread elements in the numbered series of screws below ¼ in, nominal diameter, on the basis of the Unified Thread formulae, although these sizes are not formally identified as Unified. The reader will find indicated those sizes which through long usage have tended to become in effect a simplified series, and also those sizes which the United Kingdom is prepared to adopt for general engineering purposes.

United States Department of Commerce, National Bureau of Standards, Washington.

1950 Supplement to National Bureau of Standards Handbook 29, 1944, "Screw-thread Standards for Federal Services". 50 cents.

This 1950 supplement includes the unified standards for thread form, for the coarse-thread series in sizes from ¼ inch to 4 inches, inclusive, and for the fine-thread series in sizes from ¼ inch to 1½ inches, inclusive, as agreed in the

1948 Declaration of Accord. It also includes subsequently agreed upon Unified special threads and American National diameter-pitch combinations that have not been recognized as unified standards, but for which allowances and tolerances have been formulated in accordance with the principles of unified threads.

TECHNICAL BULLETINS RECEIVED

American Institute of Electrical Engineers. Standards:

No. 27 — Standard for switchgear assemblies and metal-enclosed bus.

No. 45 — Recommended practice for electric installations on shipboard.

American Standards Association. Standards:

No. Y32.1.1 — Graphical symbols for single (one) line electrical engineering diagrams.

British Electrical and Allied Industries Research Association. Technical Reports:

No. M/T108 — An improved harmonic analyser and noisemeter.

No. Q/T126 — The causes and effects of water in oil-immersed transformers, M. R. Dickson.

California University. Publications in Mathematics, new series:

Vol. 1, No. 9, pp. 341-384 — Distributive and modular laws in the arithmetic of relation algebras, by L. H. Chin and Alfred Tarski. Vol. 1, No. 10, pp. 385-396 — Ring-logics and p-rings.

Canada. Dominion Bureau of Statistics. Publications:

The construction industry in Canada, 1950.

Canada. National Research Council. Associate Committee on Soil and Snow Mechanics. Technical memoranda:

No. 21 — The Canadian snow survey 1947-1950, by D. C. Pearce and L. W. Gold.

Royal Institute of Technology, Stockholm. Transactions:

No. 53 — Speed regulation of slip-ring induction motors for special purposes, by F. Dahlgren and P. Biringer.

United States. National Bureau of Standards. Building Materials and Structures Reports:

No. 122 — Physical properties of some samples of asbestos-cement siding.

Circulars:

No. 509 — Bibliography of Books and Published Reports on Gas Turbines, Jet Propulsion, and Rocket Power Plants.

United States. Highway Research Board. Bulletins:

No. 43 — Studies in Night Visibility.

BOOKS RECEIVED

Advanced Five-figure Mathematical Tables. C. Attwood. Toronto, Macmillan, 1951. 69 pp., 90 cents.

Canadian Who's Who: A Biographical Dictionary of Notable Living Men and Women, Vol. 5, 1949-1951. Toronto, Trans-Canada Press, c1951. 1,159 pp., $24.00.

Carburation, 3rd ed., Vol. 1: Applied Carburation and Petrol Injection. C. H. Fisher. London, Chapman, Toronto, British Book Service, 1951. 356 pp., illus., $7.25.

Cathodic Protection: Report of Correlating Committee on Cathodic Protection, July 1951. Houston, Texas, National Association of Corrosion Engineers, c1951. 33 pp., 50 cents.

Data Book for Civil Engineers, 2nd ed. Vol. 1: Design. Vol. 2: Specifications and costs. E. E. Seelye. New York, Wiley, 1951. Vol. 1: 521 pp., illus., $12.00. Vol. 2: 506 pp., illus., $15.60.

Displacement Pumps and Motors. R. Hadekel. London, Pitman, c1951. 171 pp., illus., $5.00.

Earth's Magnetism, 2nd ed. Sydney Chapman. London, Methuen, Toronto, British Book Service, c1951. 127 pp., illus., $1.25.

Electrical Year Book 1952: A Collection of Electrical Engineering Notes, Rules, Tables and Data. London, Emmott, 1952. 360 pp., illus., 3/–.

Engineering Design, 3rd ed. J. E. Taylor and J. S. Wrigley. London, Pitman, c1951. 137 pp., illus., 45/–.

Engineering Law, 4th ed. R. E. Laidlaw and C. R. Young. Toronto, University of Toronto Press, 1951. 394 pp., $4.75.

FBI Register of British Manufacturers, 24th ed., 1951 - 1952. Federation of British Industries. London, Iliffe, c1951. 882 pp., $5.00.

French-English Science Dictionary for Students in Agricultural, Biological, and Physical Sciences, with a supplement of terms in Aeronautics, Electronics, Radar, Radio, Television, 2nd ed. Louis De Vries. Toronto, McGraw-Hill, 1951. 596 pp., $8.80.

Fundamentals of Automatic Control. G. H. Farrington. London, Chapman, Toronto, British Book Service, 1951. 285 pp., illus., $6.00.

Incentive Management: A New Approach to Human Relationships in Industry and Business. J. F. Lincoln. Leaside, Ontario, Lincoln Electric Co., 1951. 280 pp., $1.50.

Introduction to the Theory of Control in Mechanical Engineering. R. H. Macmillan. Cambridge, University Press, Toronto, Macmillan, 1951. 195 pp., illus., $5.75.

Manufacturing Processes, 3rd ed. M. L. Begeman. New York, Wiley, c1952. 608 pp., illus., $7.20.

Materials Handbook: an Encyclopedia for Purchasing Agents, Engineers, Executives, and Foremen, 7th ed. G. S. Brady. Toronto, McGraw-Hill, 1951. 913 pp., maps, $11.50.

Mechanical World Year Book 1952. London, Emmott, 1952. 268 pp., illus., 3/6.

Mechanics Applied to Vibrations and Balancing, 2nd ed. D. L. Thornton. London, Chapman, Toronto, British Book Service, 1951. 584 pp., illus., $10.00.

Modern Gas Turbines: with special reference to Stationary, Aircraft, Locomotive, and Marine Types and to the Supercharging of Internal Combustion Engines, 2nd ed. A. W. Judge. London, Chapman, Toronto, British Book Service, 1950. 388 pp., illus., $6.50.

Muddy Waters: The Army Engineers and The Nation's Rivers. Arthur Maass. Cambridge, Mass., Harvard University Press, Toronto, Saunders, 1951. 306 pp., illus., $6.25.

Partners in the Free World: A Summary Report on the Canadian-American Conference on Foreign Relations, Niagara Falls, Ontario, May 31 - June 5, 1951. R. K. Turner. Boston, World Peace Foundation, c1951. 103 pp., $1.00.

Piping Design and Engineering. Providence, Rhode Island, Grinnell Co., c1951. 223 pp., illus., $12.00.

Press Tool Practice, part four. P. S. Houghton. London, Chapman, Toronto, British Book Service, 1951. 257 pp., illus., $4.25.

Principles of Radio, 6th ed. Keith Henney and G. A. Richardson. New York, Wiley, c1952. 655 pp., illus., $6.60.

Structure and Mechanical Properties of Metals. Bruce Chalmers. London, Chapman, Toronto, British Book Service, 1951. 132 pp., illus., $3.75. (Vol. 2 of a series of monographs on metallic materials).

Viscosity and Plasticity. E. N. da C. Andrade. Brooklyn, Chemical Publishing Co., 1951. 82 pp., illus., $2.70.

Welding of Non-ferrous Metals. E. G. West. London, Chapman, 1951. 553 pp., illus., 55/–.

World Almanac and Books of Facts for 1952. Harry Hansen ed. New York World Telegram and Sun, 1952. 912 pp., $1.30.

Did you remember to note the

ANNUAL MEETING

dates?

MAY 7-8-9 at VANCOUVER, B.C.

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POWER FOR THE NATION'S RAIL LINES

From its locomotive plant in London, Ontario—the most complete and modern of its kind in Canada—General Motors Diesel Limited serves an increasing number of valued customers. Through the production of locomotive units which are completely engineered, built and serviced by one organization, General Motors Diesel is helping railroads meet the challenge of ever-growing civilian and defense needs.

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BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

Appointments and Transfers

William Hole.—William Hole has been appointed vice-president and managing director of American Air Filter of Canada Ltd. He was formerly with Darling Bros. Ltd., where he acted as manager of air filter and dust control sales. Mr. Hole will be in charge of all operations of his Company, a new subsidiary of American Air Filter Co. Inc. of Louisville, Kentucky.

•

W. Hole

H. Doyle.—H. Doyle, senior research engineer at the Consolidated Mining and Smelting Company has been appointed supervisor of smoke treatment and ventilation. In his new position, Mr. Doyle is responsible for the technical supervision of operation and maintenance of all smoke treatment and ventilation installations within the Company, exclusive of mine ventilation. He will also act as engineering consultant on matters pertaining to the design of such equipment and installations.

•

T. A. Lindsay.—T. A. Lindsay has been elected a vice-president and director of Automatic Electric (Canada) Limited, Toronto. He has been general manager of the Company for the past seven years and will continue in that capacity.

•

C. C. Rathgeb. — C. C. Rathgeb has been appointed to the board of directors of General Steel Wares Limited. Mr. Rathgeb is also president of Canadian Comstock Company Limited, Comstock Midwestern, Comstock Shipbuilding Limited, and St. Catharines Steel Products Limited.

•

B.A.-Shawinigan Appointments.—R. E Irwin, who has been chief chemist of the British American Oil Company Limited, Toronto since 1945, is now manager of the petrochemical plant of the newly-organized B.A.-Shawinigan Limited in Montreal East.

R. H. Hall, a member of the plant research department of Shawinigan Chemicals Limited has been appointed assistant to Mr. Irwin.

Roy Campbell of Toronto, who replaced Mr. Irwin as chief chemist of British American Oil has been elected a director of the new company.

•

G. D. Mallory.—G. D. Mallory, director of the industrial development division, Department of Trade and Commerce is now travelling in India, Pakistan and Ceylon where he is examining the industrial requirements of those countries under provisions of the Colombo plan for the economic development of south and south-east Asia. The services of Mr. Mallory are on loan to the international economic and technical co-operation division.

•

O. H. Gill.—O. H. Gill has been appointed superintendent of maintenance for the Consolidated Mining and Smelting Company. Mr. Gill will be responsible to the chief engineer for the efficiency and quality of maintenance at all operations except those in the Kimberley area. He will also be responsible for the development and installation of maintenance techniques and standard practices at all operations of the Company.

•

L. F. McCaul.—L. F. McCaul has been appointed sub-contracts manager of the aircraft division of Avro Canada.

•

H. H. Saunderson.—Dr. H. H. Saunderson has been appointed to the newly-created position of deputy-co-ordinator of the materials branch of the Department of Defence Production.

Dr. Saunderson has been director of information services of the National Research Council since 1947. In his new capacity he will be on full time loan from the National Research Council.

•

J. J. Kingan.—J. J. Kingan has been appointed general manager of the Canadian Marconi Company. In 1947 he was appointed assistant to the general manager and shortly afterwards was made responsible for the manufacturing and sale activities of the Company. In 1950, Mr. Kingan was named assistant general manager.

•

J. J. Kingan

P. H. Sevensma.—P. H. Sevensma has been appointed senior mine geologist at the Sullivan Mine in Kimberley. Dr.

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At every one of the centres shown on this map Dominion Bridge† maintains a steel warehouse with complete, up-to-the-minute facilities. This means prompt, efficient service wherever your plant may be located.

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Sevensma will be responsible for the detailed supervision of geological work for the development and mining of the Sullivan ore-body.

•

English Electric Moved.—Continuous growth in all departments of the English Electric Co. of Canada Ltd. has necessitated the removal of the entire head office sales and advertising departments from the plant to new offices in downtown St. Catharines. Both departments are now located at 51 James St.

•

F. R. MacDonald.—F. R. MacDonald has been appointed sales manager, heavy bolt division of the Steel Company of Canada Limited. He will make his headquarters at the Swansea Works of the Company.

•

John W. Harris Ltd.—The establishment of John W. Harris Ltd. as a Canadian affiliate of John W. Harris Associates Inc. of New York was announced recently.

The new corporation will make its headquarters in Toronto. Kenneth W. Damarest, executive vice-president will be in charge of operations. He was formerly associated with Fluor Corporation Ltd., process engineers and builders.

•

G. E. Bevis.—George E. Bevis has been appointed vice-president and general manager of Reliance Electric and Engineering (Canada) Limited of Welland.

Mr. Bevis has been vice-president in charge of sales since the Company was purchased from Commonwealth Electric Corporation in the latter part of 1950.

Mr. Bevis will continue to divide his time between the Toronto office of Reliance Electric and Engineering (Canada) Limited, the Welland plant, and Company offices.

•

H. Goldin. — H. Goldin, 394 Avenue Road, Toronto, has established an acoustical consulting service for architects, engineers, builders and building management.

It is claimed that this is the first full time acoustical engineering service of its kind in Canada. Mr. Goldin is offering his services with respect to problems covering the entire field of architectural acoustics, sound reinforcement, noise isolation and associated problems.

•

E. R. Davis. — E. R. Davis has announced that he has entered private practice in mechanical engineering and will specialize in heating, steam power and piping. Mr. Davis was formerly with Margison and Babcock, consulting engineers, and the Canadian Comstock Co. He will make his headquarters in Toronto.

•

Goodyear Tire Executives.—R. C. Berkinshaw, C.B.E., has been elected president and general manager of the Goodyear Tire & Rubber Company of Canada Limited. The appointment was made at the annual directors meeting held in Toronto on February 20th.

At the same meeting, A. G. Partridge, president of the company for the past sixteen years was appointed vice-chairman of the board of directors and A. W. Denny was elected vice-president of the Company.

•

Rae McGeoch.—Rae McGeoch has been named manager-marketing in Canadian General Electric Company's lamp division. He is now responsible for the entire marketing function covering the wide range of G-E fluorescent, incandescent and special types of lamps.

•

Morris C. Hay.—Morris C. Hay has been named director of employee relations of the B. F. Goodrich Rubber Company of Canada, Limited.

Mr. Hay is now in charge of the Company's employee relations division which has been newly formed to co-ordinate present employee relations functions. He will continue as counsel and assistant secretary.

•

Caterpillar Appointment. — Hewitt Equipment Limited has been named distributor for Caterpillar Tractor Company in the province of Quebec. Offices will be located in Montreal and Quebec City. For further information on Mr. Hewitt please see "Personals".

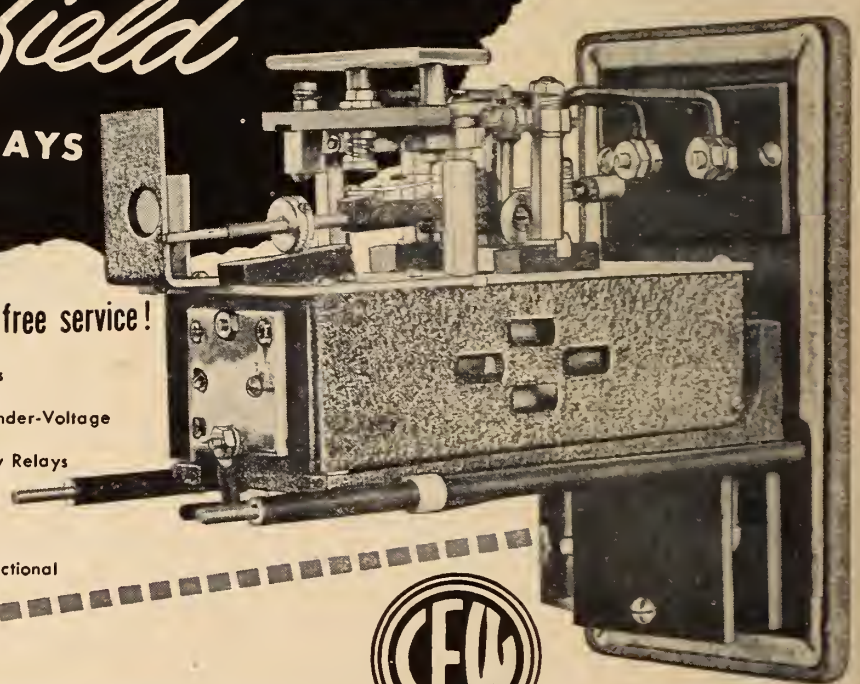
•

Annual Meeting

See announcement on pages 212-213 of this issue

Cansfield

PROTECTIVE RELAYS



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Unmatched smoothness! "Electronic" is Eagle's trade name for a blend of purest crystalline graphites reduced to micronic fineness in our patented Attrition Mill. Leads made with it 100% have a frictionless, smooth-gliding quality never approached before.

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EAGLE PENCIL COMPANY OF CANADA, LIMITED

217 BAY STREET, TORONTO, CANADA

New Equipment and Developments

Rust Removal.—Octagon Process Inc., 15 Bank Street, Staten Island 1, New York, claim to have developed a new chemical treatment for the removal of rust, tarnish and light oil. Known as "Rustclean", the new compound is claimed to destroy rust and rust-promoting surface contaminants, thereby retarding corrosion. It is claimed that the product will chemically clean the surface of steel, iron, aluminum, zinc and cadmium and that it also forms a phosphate coating which acts as a base for organic finishes. For complete information apply to the company at the address given above.

•

New Brunswick Coal.—Value of New Brunswick's mineral production exceeded $10,500,000 in 1951. Coal production was the chief item and production increased eight per cent to reach an all-time high of 651,000 tons, compared to 602,000 tons in 1950.

Ninety-two per cent of the coal production was consumed in the province chiefly by the pulverized fuel plants of the New Brunswick Electric Power Commission, the pulp and paper industry and the Canadian National and Canadian Pacific Railways.

•

Velan Steam Trap.—Velan Engineering Company, 6585 Jeanne Mance Street, Montreal have announced new features in the Velan universal steam trap.

The trap is specially designed for the processing industries where continuous, uninterrupted, operation is essential. Two special valves are incorporated in the trap and have a signalling device indicating, even to an unskilled operator, in which position the valves are placed. A draining device can be completely closed, steam and condensate can be bypassed and all internal parts of the steam trap replaced, or the condensate lines can be cleaned with live steam from alkaline deposits, scale and other matter.

Communicate with the Company for complete information.

•

Mobile Crane.—Chamberlain Industries Limited, Staffa Works, Leyton, London, E10, England, have developed a new mobile crane the "Staffa" two third ton model.

The new crane has been evolved as a result of the Company's long experience in the reconditioning of British and American made cranes. The crane is completely mechanical and has been specially constructed to reduce maintenance to a minimum.

An outstanding feature is the provision of a hydraulic ram for raising and lowering the jib. Motion is controlled by a conveniently placed lever operating a valve which is completely enclosed in an oil reservoir. Finger tip control mechanism gives easier and safer control for derricking operations. An engine driven hydraulic pump supplies the power and the ram unit is safe-guarded from failure, burst pipes or obstruction by means of a specially developed non-return valve.

Power is supplied by a Newage/Austin industrial type petrol engine developing 15 B. hp. at 1800 r.p.m. The hoisting mechanism is made up of a fan-cooled worm reduction gear upon which is mounted a grooved drum conveying 65 feet of ⅝ diameter (6 x 37) construction wire rope. Power is transmitted by a propeller shaft and chain drive from a marine type forward and reverse box.

•

Large Conical Blender.—The Patterson Machine and Foundry Co. (Canada) Ltd., Toronto, has just completed work on a conical dry blender believed to be the largest ever built. The unit is 13 feet in diameter and has a total capacity of 1,000 cubic feet and a working capacity in excess of 700 cubic feet.

Developed for blending a mixture of technical gelatin and antifoam paste, which has a combined weight of 42 lbs. per cubic foot, the blender holds a batch of approximately 30,000 pounds. The entire contents of a railroad car can be intimately and uniformly blended in a single batch operation. The blender was built for a customer whose process could not be handled in segments and still maintain the necessary uniformity of product.

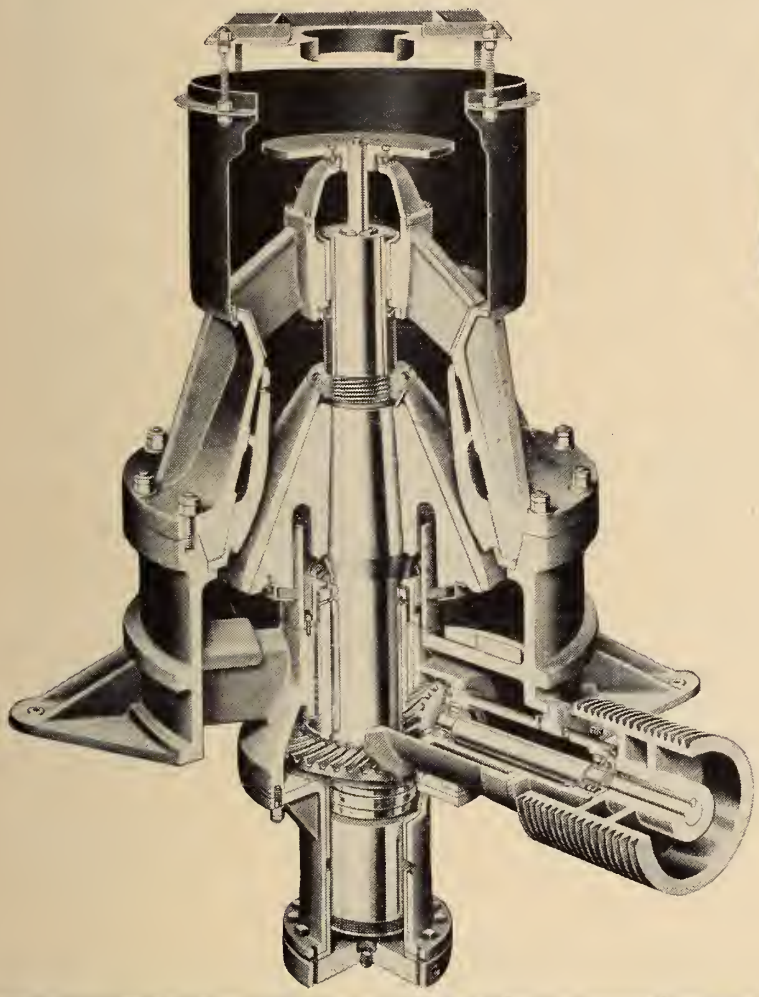
•

Scrap Salvage. — Heavier demands on Canadian steel production to support national preparedness and progress have indicated the need for increasing the flow of iron and steel scrap to the mills and foundries. To encourage this, iron and steel companies across Canada will sponsor a national scrap iron and steel collection program.

Following conferences attended by

Designed for

Efficient Fine Crushing



HYDROCONE
GYRATORY
CRUSHER

The *Hydrocone* crusher is tailored to your job. It is designed to operate most efficiently with a predetermined ratio of eccentric throw to crusher setting for a given application. By this, the most desirable crushing conditions are attained — economical use of crushing surfaces . . . reduced crusher maintenance . . . a more cubical product.

The eccentric throw is controlled by a replaceable bronze sleeve in the cast steel eccentric. This sleeve, being a wearing part, can be renewed readily in the field, or if operating conditions change, the throw of the crushing head can be changed accordingly.

NO DEAD WEIGHT

All the weight in the *Hydrocone* crusher is concentrated into resisting the crushing force. Top and bottom shell, eccentric and spider cap are of cast steel construction. The short, heavy mainshaft is annealed forged steel. Mantle and concaves are of a special steel.

Hydraulic *Speed-Set* control enables the operator to change product size quickly and easily. Automatic Reset provides hydraulic protection from tramp iron.

More facts about the *Hydrocone* crusher can be obtained from the nearest CA-C sales office, or by writing for *Hydrocone* crusher bulletin 07B7145B.

In a special test, oscillograph readings of strain on a *Hydrocone* crusher were made at various points on the topshell spider, topshell, bottomshell and bottom plate. The stress analysis showed that the strain on the crusher did not exceed 4000 psi. at any point — even though hard taconite ore was being crushed. The test indicated how well various parts of the *Hydrocone* crusher are proportioned for strength — vital to long life and low maintenance.

Texrope, Pulverator, Hydrocone and *Speed-Set* are Allis-Chalmers trademarks.

CANADIAN ALLIS-CHALMERS (1951) LIMITED
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A-C ALLIS CHALMERS

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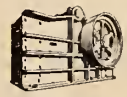
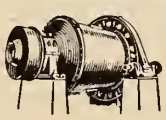
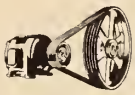

Jaw Crushers


Grinding Mills

Gyratory Crushers

Kilns, Coolers, Dryers


Texrope Drives

representatives of the major companies from British Columbia to Nova Scotia, a national committee was formed to sponsor the drive for scrap. This new organization has been named the Canadian Scrap Iron and Steel Committee.

The committee is made up of T. C. Wilkes, Steel Company of Canada, chairman; D. A. Lindsey, Dominion Foundries and Steel; Neil Metcalf, Burlington Steel Company; A. D. Texter, Atlas Steels Limited; A. A. Kennedy, Wm. Kennedy & Son; G. H. D. Hobbs, Vancouver Rolling Mills; J. L. Stewart, Manitoba Rolling Mills; W. L. Knudson, Algoma Steel Corporation; A. R. Oliver, Steel Company of Canada; Peter Craig, Canadian Car and Foundry Company; B. Rider, Dominion Steel and Coal Corporation; A. R. Hackett and Henry Janes.

The executive offices of the committee will be at 33 Scott Street, Toronto.

•

Pneumatic Wrench. — A new ⅜ in. portable pneumatic reversible impact wrench has been announced by the Independent Pneumatic Tool Co.

Key features of this new piece of equipment are an exclusive rolling ball type cam which increases efficiency and other changes designed to increase power and give longer service life. The new wrench is available with two types of spindles—size 24 with ½" square drive and a size 24S with a 7/16" hexagon quick change chuck integral with the spindle. For further information write to Independent Pneumatic Tool Co., 175 North State Street, Aurora, Ill.

•

Aircraft Instrument Plant.— A modern aircraft instrument plant is being built near Montreal. The plant, for which the steelwork has already been erected, is being erected for the Canadian government and will be operated by the Sperry Gyroscope Company of Canada Ltd.

The plant is located on the Cote de Liesse Road. Sperry will begin assembly of aircraft instruments for the armed services before the end of 1952.

The new plant will have an area of approximately 85,000 square feet and will eventually employ six hundred people. More than a million dollars worth of machine tools and equipment will be required to place the plant in full scale operation. Design was by T. Pringle & Son Ltd. of Montreal.

•

Magnetic Jig.—A new Canadian product, the permanent magnetic universal jig, has been announced by Air Reduction Canada Limited. This new type jig can be used for positioning pipe, sheet, plate or tubes for tacking, using either arc or oxy-acetylene welding.

Used singly, in pairs, or multiples, this jig can be adapted for butt or fillet welds in various assemblies. It measures 6½" overall by 1½" surface square and weighs approximately 3½ pounds. It is grooved to handle up to 4" diameter pipe, and precision tooled to provide 45° or 90° angles. For complete information write to Air Reduction Canada Limited, 180 Duke Street, Toronto, Ont.

•

Foxboro Expansion. — With increasing use by industry of instruments to indicate, record and control temperatures, pressures, liquid level, flow, humidity, specific gravity and other physical variables, The Foxboro Co. Ltd. is again expanding its Canadian manufacturing facilities. In 1947 the Company built a plant on a 3½ acre site at Ville LaSalle, Montreal. The current demand has necessitated an extension which will more than double the present capacity.

Ground has been broken for a 23,000 foot additional floor space extension. This will give a total of 37,000 feet on one level for manufacturing. Another 5,000 feet will be on a lower level, due to contour of the ground, and will include a cafeteria equipped to feed 150 people at one sitting. There will also be a lecture room and an instrument workshop for students.

The new building will be of steel frame, concrete brick construction, with a large amount of glass brick. Cost of construction is estimated at around $250,000 and machinery and installation will cost approximately $100,000. Foxboro Co. Ltd. is associated with The Foxboro Co. of Foxboro, Mass., and Foxboro-Yoxhall Co. Ltd. of Great Britain. Canadian sales representatives are Peacock Brothers Limited.

•

Monsanto in B.C. — A new $100,000 laboratory and office building for Monsanto Chemical Limited will be erected in Vancouver.

•

Underwriters Approved

McAvity-Milwood Gate Valves—

WITH IRON BODY FULLY BRONZE MOUNTED . . .
FOR 175 LBS. COLD WATER PRESSURE NON-SHOCK

They start tight and stay tight through years of service . . . these McAvity-Milwood Gate Valves. Their exclusive, patented, self-aligning seats ensure a perfectly tight seal between gate and seat with each closing. Where underground installation is desired, they can be operated by McAvity F.M. approved Indicator Posts . . . which show positively whether valve is open or closed.

McAvity-Milwood "Underwriters" Valves are available with the following end connections: Flanged, Screwed, Hub, Victaulic, or Universal Pipe. Complete details from our nearest branch.

FIG. 10072
for Indicator
Post operation.

T. McAvity & Sons LIMITED

Established 1834

SAINT JOHN, N.B.

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Pipe-line Contract.—A one half million dollar sub-contract for unloading, stock-piling and stringing pipe along 260 miles of right-of-way for the Edmonton-Vancouver oil line, has been awarded Arrow Transfer Co. Ltd. of Vancouver.

Award was made by Fred Mannix Ltd. of Calgary a major contractor of the pipeline.

Work on the first phase of this project, which will take approximately two years to complete, will begin in mid-April. Initially, a 100-mile section from Vavenby to Blue River will be undertaken. A base camp is now being constructed at Vavenby. The second stage of the project will be a 160-mile section from Vavenby west to Coquihalla.

Pipe, two feet in diameter, will be strung in 40-foot lengths. Prospective date for pipeline delivery of crude to Vancouver is early 1954.

•

B.T.H. Achievement. — British Thomson-Houston believe that their greatest engineering achievement in 1951 was the proving of gas turbines for ship propulsion. A BTH turbine proved successful in the trial, last year, on the tanker Auris, the first ocean-going merchant ship to be thus powered.

•

Imperial Oil Regina Plant. — Tenders will be called early this spring for a $7 million modernization program at Imperial Oil's Regina refinery.

When completed, the refinery will have a capacity of 22,500 barrels daily, compared to a current output of 20,000 barrels. New units are to include an 8,100-barrel-a-day vacuum pipe still, a 7,500-barrel-a-day fluid catalytic cracking unit, a light end plant and treating facility, new steam generating equipment and additional storage tanks.

The refinery will continue to make the same major products — motor gasolines, naphthas, fuel oils and asphalt. It will continue to draw its crude oil by pipe line from Leduc and Redwater fields.

•

International Nickel Output. — The International Nickel Company of Canada Limited mined more ore from underground in 1951 than in any year in its history. Production of ore from underground in 1951 was 7,780,000 tons, an increase of 2,000,000 tons over that of the previous year.

•

Bowaters Contract. — Bowaters Newfoundland Pulp and Paper Mills Limited has awarded contracts for a $4,000,000 construction and mill improvement job to two companies. The companies are Terminal Construction Company Limited of Montreal and Moncton, N.B., and the Newfoundland Engineering and Construction Company Limited of Corner Brook and St. John's.

•

Orenda Passes Test.—The production model of the Orenda, Canada's own designed and made jet engine, has successfully completed the running of the official 150 hour type test. This means that the production engine has cleared the rigid test schedules required by the R.C.A.F.

•

Blast Holes.—Secondary blast holes are now being pierced at a rapid rate in some quartzite and sandstone quarries, using multiple hand operated jet-piercing units supplied with oxygen, fuel and water from a compact mobile carrier. A unit of this type, operating in a Canadian quarry enabled four jet-piercing blowpipes to pierce blast holes for two hours without shutdown.

The piercing blowpipes used were developed by Dominion Oxygen Company Limited and Linde Air Products Company. The mobile supply carrier was constructed by the quarry from specifications supplied by them and modified by the quarry operators for their particular use. For complete information write to Dominion Oxygen Company Limited, 159 Bay Street, Toronto 1, Ontario.

•

Mercury Lamp.—What is described by Canadian General Electric Co. Ltd., as one of the most important mercury lamp developments in recent years, has been announced. The new mercury lamps expected to play an important role in the nation's industrial mobilization program, are being introduced. They are the first of that type for general lighting service to have reflectors built into the bulb. Their chief advantage, over previous mercury lamps, is that they ordinarily will need no cleaning or other maintenance throughout their lives.

The lamps are produced in the 400-watt size. Housed in the R-52 bulb, which is 11¾ in. long and 6½ in. diameter at the face, where the light is emitted, they have a life rating of 3000 hours at five hours per burning start, and 4000 hours at 10 hours per start. One lamp, the H400-R1, generates light of the regular mercury colour. It has a lumen output of 14,500. The other lamp, the H400-RC1, is physically the

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same except for a coating of phosphor on the inside face of the bulb. This improves the colour quality of the light, particularly in its effect upon the human complexion, and helps smooth out the light beam. The lamp has an output of 10,000 lumens. Now in production, the new lamps are available nationally in limited quantities.

•

New Style Pump.—The invention of a revolutionary new type pump for various industrial and aviation uses was announced, recently, by the Drexel Institute of Technology, Philadelphia 4, Pennsylvania.

The pump is especially suited for use in the chemical, oil and food industries. It was developed in the Drexel's laboratories by William Gemeinhardt, a 45-year-old former flier and research engineer in the Hungarian Air Force.

The principle of the new pump is vibration instead of rotation. It has but one vane. A curved axle rotates within a hermatically sealed flexible tube which extends into the pump chamber. Due to its curvature, the axle moves the flexible tubing in a circular arc. The vane, attached to the end of the tube travels the same path and pushes liquid out through the exit hole of the pump chamber.

According to the inventor "It has no packing whatever, and therefore, requires no lubrication. Packing must be lubricated and this creates contamination. The Vibro Pump can be taken apart and cleaned in a matter of minutes. It has no valves and no bearings It has only two main parts, the housing and the agitator".

•

Canadian Electrical Code.—Part VI of the Canadian Electrical Code, a division for the setting of minimum requirements covering electrical equipment for mines has now been established and several meetings have been held. This information came from the Canadian Standards Association.

Number one specification for mining type transformers is under the chairmanship of H. W. Ellis, design engineer, Ferranti Electric Ltd. with nine members on this sub-committee. This proposed standard covers liquid-filled transformers having ratings of 300 kva, three-phase and 200 kva single-phase and less for potentials 7,200 volts and less for underground workings where hazardous gases may prevail. A preliminary draft is being prepared for submission to all members of the sub-committee. For further information apply to the secretary, D. S. Martin, Approvals Laboratories, 77 Florence Street, Toronto, Ont.

•

Statistical Quality Control Course.—In response to a widespread demand the College of Engineering at the University of Colorado will conduct its third annual training course in statistical quality control during the period June 17-27. The course will include the quality control charts, acceptance sampling and other industrial statistical methods. For details write to John F. Wagner, College of Engineering, University of Colorado, Boulder, Colorado, U.S.A.

•

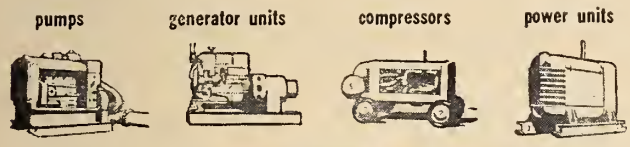
Chemical Exposition. — The industrial uses of atomic energy will provide an important part of the program to be presented at the seventh National Chemical Exposition in the Chicago Coliseum, September 9th to 13th.

In addition, the Exposition committee of the Chicago section of the American Chemical Society, sponsor of the Exposition, is planning a half-day symposium on the general theme of the future of chemistry. The 1950 Exposition, which attracted nearly 20,000 visitors, revolved around the theme of chemistry's great achievements in the preceding half century. This year it is the committee's plan for experts in their fields to talk on the chemical opportunities and possibilities of the balance of the 20th century.

•

Canadian-U.S. Agreement. — Representatives of the Department of Defence Production and of three United States military departments signed an agreement on February 26th standardizing procedures and policies for the procurement of military supplies in Canada by the United States miltary departments.

The agreement provides that contracts placed by the U.S. military departments in Canada will generally be placed with the Canadian Commercial Corporation, a Crown company, which will in turn place these contracts with Canadian industry. The agreement also



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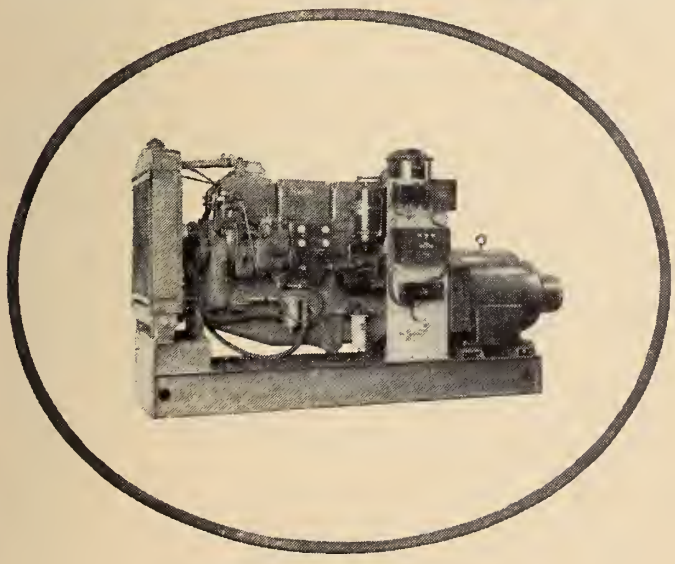

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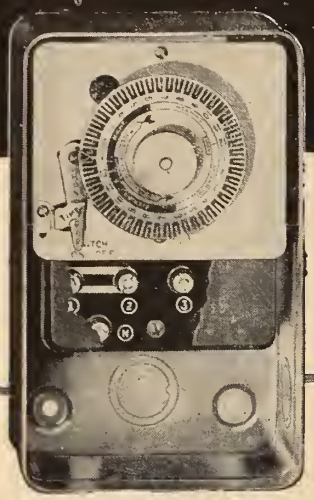

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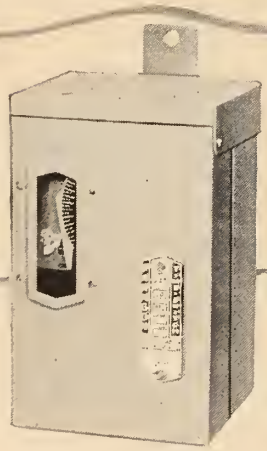

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contains provisions relating to overall profit limitations with respect to contracts placed in Canada and the utilization by each country of the material inspection services. This agreement will simplify contract negotiations since many details previously covered by individual contract negotiations are now included in the overall agreement.

●

Treatment Of Polluted Water.—Treatment of highly polluted and turbid waters for industrial purposes presents a serious problem in purification. Installation of a new plant—the first of its kind to be operated in Britain — has enabled a paper-making firm to overcome this difficulty, and recognition of its many potential uses has already been shown by inquiries from firms in all parts of the world.

This new plant, manufactured by the Pulsometer Engineering Company, Nine Elms Iron Works, Reading, Berkshire, England, is known as the Pulsometer ionomatic water purification plant process. It treats the polluted water by using specially activated silica in conjunction with sulphate of alumina. Compared with the usual water purification process, it is claimed that this method economizes in space and size of plant.

●

Moisture Testing Meter. — Foundrymen will be interested in a new meter for testing the moisture content of sand piled on the floor. The testing rod is pushed into the sand and readings are taken from the meter scale. Given a sufficiently long lead, the rod can be used for checking sand in hoppers, mixers or storage heaps; in fact, anywhere in the foundry where a moisture test is required. The instrument is electrically operated, is cheap to install and can be fitted to existing equipment. Once switched on, the meter is in continuous operation.

The meter is made by Industrial and Scientific Instruments, Limited, of Emel House, 30, Teville Road, Worthing, Sussex, England, who have also produced a novel detergent strength indicator, which is finding many applications in dairies and breweries and should soon go into operation in hotels, canteens and similar institutions.

●

Setting Nylon Fabrics.—A new continuous machine for setting nylon fabrics has been introduced by the Spooner Dryer and Engineering Company, Limited, of Ilkley, Yorkshire, England. The machine is based on the company's standard stenter frame with pin chains, has an overfeed device and a photo-electric system for guiding the light fabric on to the pin chains. Heating may be by gas or electricity.

The guiding of the fabric on to the pins is by an adaptation of the photo-electric scanning principle. Standard practice is for the light beam to be directed straight on the edge of the cloth, but with fabrics of the lightness of some rayon materials the beam is not effectively interrupted, nor can the sensitivity of the system be adjusted satisfactorily. By using a light lever and allowing the light ray to be interrupted by one arm of the lever instead of by the edge of the cloth an adjustable variation can be obtained. The backing units of the machine are of the Spooner standard type but instead of steam, gas or electricity is used for heating.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

"Scotch" Tapes. — Minnesota Mining and Manufacturing of Canada Limited, P.O. Box 757, London, Ontario, offer a folder describing "Scotch" Brand pressure-sensitive filament tapes for industrial uses. These tapes get their strength by laminating acetate film with rayon or glass wool fibres. There are as many as 5,000 unbroken filaments of rayon for every inch of width and a tensile strength of 180 lbs. per inch of width is claimed. When reinforced with glass fibre the tensile strength is further increased to 500 lbs. per inch of width.

●

Welding Articles.—Three new reprints of articles on Aircomatic welding have been announced by Air Reduction Sales Company. These articles originally appeared in "The Welding Journal" and were given before the annual meeting of the American Welding Society.

The titles are "Aircomatic Welding of Austenitic Stainless Steels" by W. G. Benz, Jr. and J. S. Sohn. "Aircomatic Welding Refinery Components and Pressure Vessels" by Stephen Yaczko describes procedures for welding stainless, stainless clad steel, low-alloy steel and copper-alloy pressure vessels with the inert-gas-shielded metal-arc process. "Inert-Gas-Shielded Metal-Arc Welding of Magnesium" by Paul Klain describes an investigation conducted to evaluate the application of the inert-gas-shielded metal-arc process to the welding of magnesium. Copies of these reprints can be obtained from Air Reduction Canada Limited, 180 Duke Street, Toronto, Ont.

●

Instrument Data.—George Kent Limited of Luton, Bedfordshire, England, offer a small pocket size publication "Meters and Industrial Instruments—Indicating Integrating—Recording—Controlling". This publication will be very helpful to engineers who are interested in instrumentation.

●

Mechanical Seals. — Flexibox Limited, Nash Road, Trafford Park, Manchester 17, Lancashire, England, offer a small leaflet—No. A-4 in which is described "Flexibox Mechanical Seals".

●

Travelling Cranes. — Wharton Crane and Hoist Co. Ltd., Station Road, Reddish, Stockport, England, have produced Catalogue No. W.H. 101 in which is described the Company's overhead electric travelling crane. Copies will be forwarded to Journal readers on receipt of request. Address requests to the Company.

●

Hopkinsons Valves.—Hopkinsons Limited, Huddersfield, England, have produced a booklet describing their methods

(*Continued on page 286*)

125 Years of Experience There

Pilkington Window Glass, first made in St. Helens, England, in 1826, is now being made in Canada at Scarborough, Ontario.

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(*Continued from page 282*)

of producing valves, boiler mountings and other similar products which they manufacture. They are represented in Canada by Peacock Brothers Limited, Town of LaSalle, Montreal, Que. Write to the Canadian company for copies of the publication and ask for Booklet No. 5100.

•

Diesel Drilling Units.—Davey, Paxman and Co. Ltd., Colchester, Essex, England, have prepared a three colour publication to describe their "Oilwell Diesel Drilling Units". The publication is very informative and highly attractive in appearance. For copies apply to the Company and ask for publication No. 1246.

•

Sigmund Pumps. — Sigmund Pumps Limited, Team Valley, Newcastle upon Tyne, England, have prepared an eight page folder in which is described their manufacturing facilities. The publication is well prepared and copies will be forwarded by the manufacturer on receipt of request.

•

Wrought Iron Booklet. — "Proof by Performance" is the title of an illustrated eight page booklet just released by A. M. Byers Company, America's largest wrought iron manufacturer.

The publication describes, in non-technical style, a number of installations in which wrought iron gave outstanding service over long periods of time.

For copies write to A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

•

Control Thermometers. — Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont., have just released a new technical bulletin on "Electr-O-Vane Control Thermometers". This specification sheet describes Honeywell's Electr-O-Vane control thermometer, having snap action electronic control. It consists of four pages and gives a comprehensive resume of the models available. Write to the Company and ask for Specification Sheet No. 609.

•

Flue Gases. — Instrument Data Sheet No. 10.15-3a describes the Davis indicating and recording flue gas analyzer which utilizes a Davis thermal conductivity gas analyzer in combination with a Brown ElectroniK recorder. The combined apparatus provides continuous recorded combustions analysis. The data sheet describes the equipment and explains how it is used for combustion control analysis and it also explains the operation and construction of the apparatus. Write to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont., and ask for Data Sheet No. 10.15-3a.

•

Oscillating Conveyors.—A new 24 page illustrated Book No. 2444 on Positive Action Oscillating Conveyors or conveying, feeding, cooling, and screening a great variety of loose bulk materials is announced by Link Belt Limited. The book gives dimensions, weights and capacities and horsepower charts on Torsion Mount oscillators for heavy duty as well as for the recently announced flexmount oscillator for the lighter-duty applications. Write to Link Belt Limited, Eastern Avenue at Leslie and Keating Street, Toronto 8.

•

Unit Heaters.—Air Conditioning Engineering Co. (Canada) Ltd., 636 St. Paul St. W., Montreal 3, Que., offer Journal readers a copy of a new bulletin describing an improved line of Condair unit heaters. Ask for Bulletin No. 33.

•

Welding Publication.—Canadian Liquid Air Company, Ltd., 1111 Beaver Hall Hill, Montreal, will be pleased to place *Journal* readers on the mailing list for their new publication "Arc and Flame". No. 1 of volume 2 is devoted to articles describing the welding of white metal; the welding of carbon steel grouser bars, and modifying standard oxy-acetylene apparatus to cut circles and curves.

•

Beta Gauge. — An eight page bulletin describing the use of the AccuRay Beta Gauge in the rubber and plastics industries has been published by Industrial Nucleonics Corporation. The bulletin describes how the non-contacting Model R AccuRay provides direct square yard weight readings of calendered fabrics and sheet materials moving on production lines, with an accuracy of one-per cent or less. Write for bulletin R-52 to Industrial Nucleonics Corporation, 1025 Chesapeake Avenue, Columbus 12, Ohio.

•

Dominion Bridge Boiler. — Dominion Bridge Company, Limited, P.O. Box 280, Montreal, Que., are now producing a new type of boiler. Known as the type S B Water Tube Boiler it is a development from the "Custom Made" Dominion Bridge Water Tube Boiler. It is manufactured expressly for the small to medium field of boiler users. Write to the Company and ask for Type S B Water Tube Boiler bulletin.

•

Trane Publication. — Trane Company of Canada Limited, publish, at regular intervals, a publication "Weather Magic". This is a highly interesting publication and the publishers will be pleased to place Journal readers on the mailing list for regular receipt if so requested. The address is, Trane Company of Canada Limited, Mowat Avenue at King Street West, Toronto, Canada.

•

Dexion News. — Dexion Limited, 189 Regent Street, London, W.1, England, publish a magazine "Dexion News". This publication is devoted to the description of applications and ideas utilizing the "Dexion Angle". The publication is well produced and the manufacturer will be pleased to send copies on receipt of requests.

•

Plant At Home. — Engineers who are interested in public relations will recollect that recently the Howard Smith Paper Mills Limited had an open house week at Cornwall, Ontario. The management and staff of the Cornwall division of the Company invited the people of Cornwall and vicinity to see an industrial exhibit of paper making, and other products, in the local armoury. The citizens were also invited to visit the paper mill during the evening. To augment this effort the local newspaper "The Daily Standard-Freeholder" issued a special supplement on Friday, February 1st. Copies of this supplement may be obtained by applying to the publisher of the paper in Cornwall.

•

Atlas Steel News.—No. 1 of Volume 4 of Atlas Steel News is now available to readers of the Journal. Write to the Atlas Steels Limited, Welland, Ont., and ask to be placed on the mailing list for the publication.

•

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15,500 copies of this issue printed

SPRAY HYDRO-ELECTRIC POWER DEVELOPMENT

by

G. V. Eckenfelder, M.E.I.C.,

Resident Engineer,
Montreal Engineering Company.

A paper to be presented at the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, B.C., May 7, 8, 9, 1952.

In order to provide a much needed increase in output of electric energy, as well as additional generating capacity, in the Province of Alberta, Calgary Power Limited recently completed the construction of a hydro-electric project on the Spray River, a tributary of the Bow, which joins the latter at Banff. By means of extensive diversion works it was possible to utilize a gross head of 1,285 feet. This necessitated the construction of three plants, with an aggregate installed capacity of 88,600 horsepower.

This paper describes the features of the development, and its construction. It discusses in detail the serious difficulties encountered and how these were overcome.

Introduction

Calgary Power Ltd. is the principal producer of electric power in the Province of Alberta. Its main transmission system, of some 3,500 miles, serves a large part of the Province and has interconnections with all other major systems in the Province. Its generating facilities, prior to the completion of the Spray Development late in 1951, consisted of five hydro plants on the Bow River and its tributaries with an aggregate installed capacity of 117,000 horsepower and one 9,000 kilowatt steam plant leased from the City of Calgary. The system load has been growing at the rate of some 15,000 kilowatts per year, and in order to meet this growth the Spray Development, with a capacity of 88,600 horsepower, was started in 1948.

Of the existing plants, three are located on the Bow River itself, and the other two are, respectively, on the Cascade and Kananaskis Rivers, tributaries which flow into the Bow above the main river plants. The Spray, also, is tributary to the Bow, and joins the latter at Banff, well above the Bow River plants. Any storage reservoirs built in conjunction with developments on such tributaries enhance the value of these plants through the resulting increase in winter flow. Furthermore, the development of potential sites on the Bow will be made more attractive as a result of these storage reservoirs. The Spray Development, in addition to providing a relatively large plant capacity, also includes a large storage reservoir.

Topography of Spray Drainage Area

The Spray River rises in the region of the Continental Divide sixty miles South of Banff, Alberta. It flows in a northerly direction for twenty miles, and in an Easterly direction for five miles to a point where it turns sharply to the North through a canyon one and a half miles long. It joins the Bow River at Banff, dropping over 1,000 feet in that distance. Just above the canyon, Buller Creek flows into the Spray from the North. It drains the Spray Lakes valley, which occupies the space between the Bow at Canmore, and the lower reach of the Spray River. The Spray Lakes, prior to the construction of the development, were two small bodies of water which were separated by a low divide from the Goat Creek drainage. This creek rises just to the North of this divide and flows northwards to join the Spray River about eleven miles away. There is no marked indication of the height of land separating the Spray Lakes from Goat Creek. Both watersheds occupy the same broad trough lying between two ranges of high mountains. In the range to the East, at a point South of Canmore, there is a narrow cleft known locally as Whiteman's Pass, giving access to the Bow.

Water Supply

The drainage area of the Spray above Spray Canyon is 200 square miles. The mean regulated flow is 300 c.f.s., to which can be added some 20 c.f.s. by the diversion of a

part of Smith-Dorrien Creek from the Kananaskis Drainage to that of the Spray. This represents 172,000,000 kwh. output per annum from the Spray Plants.

Head Available

The floor of Whiteman's Pass is at Elevation 5,500 feet above sea level, or 1,205 feet above the Bow at Canmore. The latter lies about two miles away from the top of the Pass. Of the difference in elevation, 900 feet is concentrated in one almost vertical drop. In this concentration of head lies the value of the development. The utilization of this head involves the bringing of the waters of the Spray River from the Canyon, some sixteen miles to this point.

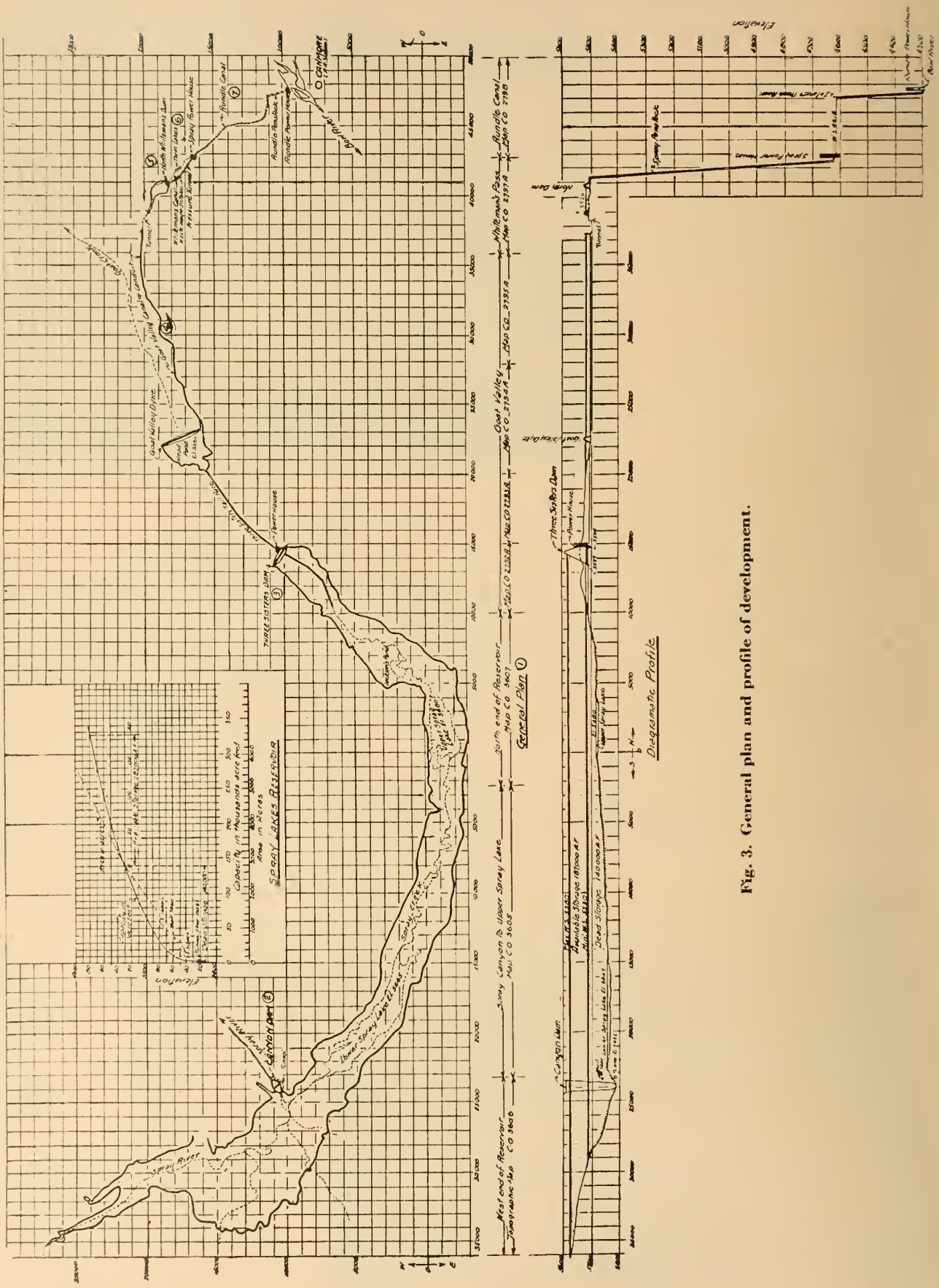
Alternative Methods of Development

As originally conceived, the scheme would have included a tunnel two miles long through the range at a point known as Windy Pass. This tunnel would conduct the water to two plants in series, located on the Eastern slope of the range between the Three Sisters and Mount Lougheed. The lower of these plants would discharge into the Bow opposite "The Gap". Investigations disclosed conditions adverse to tunnelling. The alternative was to build a system of canals leading to Whiteman's Pass. Intake works would be located at the north end of the Pass and a penstock would carry the water to a plant located 900 feet below. From here the tailwater would travel in a canal to the intake of the lower plant, where the remaining 325 feet of head would be utilized. This alternative appeared to be less hazardous and less costly than the long tunnel scheme, and was therefore adopted.

Fig. 1. South end of Spray Reservoir; Canyon Dam in the foreground.

The main diversion dam is situated at the upper end of the Spray Canyon, where the water elevation, prior to the construction of the dam, was 5,420 feet. The elevation of Goat Pass is 5,540 feet, which means that in order to bring the water through to Whitman's Pass, a dam with a minimum height of 120 feet would have to be built. This, of course, would provide no storage whatever. In order to provide adequate storage and also to take advantage of an attractive spillway site at the Canyon, the full supply elevation was chosen at 5,583 feet. This provides a live storage of 180,000 acre-feet, which can be refilled in a year of average run-off. The elevation of Goat Pass being 5,540 feet, the reservoir level at full supply is 40 feet above the natural ground at the Pass, and it was therefore necessary to dam the valley at this point, in order to contain the reservoir. This dam is known as the Three Sisters Dam, being located immediately to the South of this well-known mountain. The slope of the valley floor, both ways from the site of the dam is very flat. Therefore, the lower regulation was pretty much determined by the elevation of the pass, as a drawdown much greater than this would have necessitated an unduly large volume of excavation in the approach and discharge canals. With these considerations in mind, the lower regulation was set at 5,527 feet. This necessitated a total length of approach and discharge canal of 13,000 feet. The volume of earth

Fig. 2. Goat Valley looking north. Three Sisters Dam and north end of reservoir in foreground. Goat Dyke and Sidehill Canal in the distance (Banff is at extreme end of the valley).


SPRAY LAKES RESERVOIR
General Plan
Diagramatic Profile
Capacity in Thousands acre feet
Area in Acres
Elevation
THREE SISTERS DAM
Three Sisters Dam
Rundle Canal
Goat Valley Dyke
Spray River
Spray Creek
Canyon Dam
Canyon Tunnel
Spray Power House
Spray Penstock
Spray Lake
Upper Spray Lake
Dead Storage 140,000 A.F.
Available Storage 187,000 A.F.
Max. W.L. 5120
Min. W.L. 5100
Max. W.L. 5125
Min. W.L. 5105
Max. W.L. 5130
Min. W.L. 5110
Max. W.L. 5135
Min. W.L. 5115
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Min. W.L. 5120
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Min. W.L. 5125
Max. W.L.

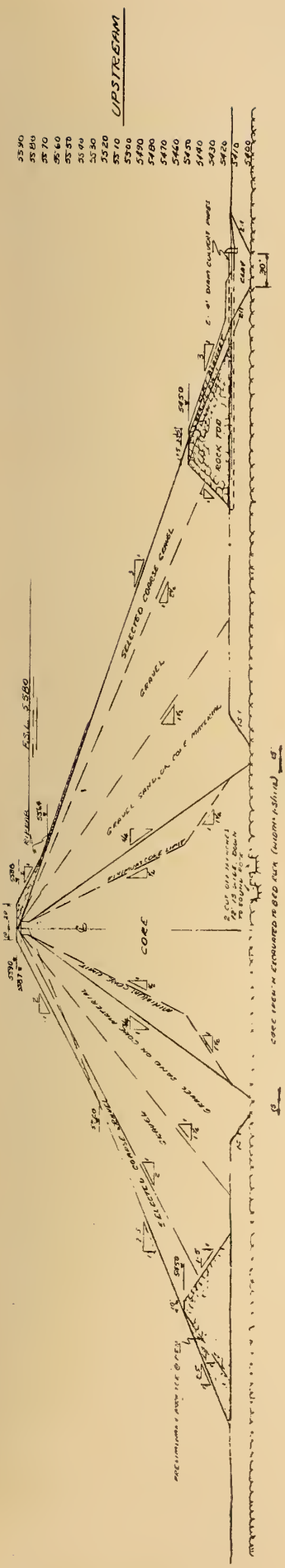


Fig. 4. Typical cross section of Canyon Dam.

excavation is 283,000 cubic yards. The floor of the canal, at the dam, is 18 feet below the original ground. In view of the head created by the dam, it was possible to install here a small power plant, called the Three Sisters Plant, with a capacity of 3,600 horsepower. While the installation of this plant was not entirely economical, it was desirable as a means of controlling the flow to the canal system. This was available for use only with the reservoir above a certain elevation. Provision was made to by-pass the plant during periods of low reservoir.

Canal and Conduit System

The discharge canal from Three Sisters plant leads to a 270-acre regulating pond known as Goat Pond, which feeds a canal system built along the East side of the broad valley, thence through a tunnel driven under a spur of the mountain and into Whiteman's Pass. A small earth dam, known as "The North Dam", at the North end of the pass forms a pond 27 acres in extent. From this pond a short canal in rock leads to the Spray Plant Intake Works. Here the water enters a penstock tunnel which drops 1,250 feet on a 45-degree incline. Then it runs horizontally 915 feet to the powerhouse. The latter contains one 62,000 horsepower Francis Turbine, driving a 47,500 kva. generator.

This unit discharges into a pond formed by the damming of Canmore Creek, and from here, a canal and dyke, about one and one-half miles long, leads to the Rundle Intake. The last step consists of a steel penstock 1,300 feet long feeding a 23,000 horsepower turbine in the Rundle Plant, which discharges into the Bow at Canmore. Thus, with full reservoir at Spray, a total gross head of 1,290 feet is utilized.

Design and Construction of Major Works

The Main Dam at Spray Canyon

The Canyon Dam is an earth fill structure with a core of rolled glacial till and graded gravel embankments. The upstream slope of the dam is 3½ to one, and the downstream 2½ to one, these slopes being steepened near the crest. The crest is 20 feet wide. The upstream face down to an elevation slightly below extreme low regulation is protected by a two-foot thickness of truck placed quarried rip-rap. The maximum height of the dam, from lowest foundation rock to crest, is 192 feet.

The character of the rock and foundation conditions in the area of the main dam were determined from outcrops, from numerous test pits and from the rock cores from 2,883 feet of diamond drilling in the canyon, of which 1,881 feet were drilled during earlier exploration in 1924 and 1925.

The Spray Canyon marks the break between two mountain blocks, namely, the Goat Range on the East and the Mt. Turbulent block, which is the continuation of the Bourgeau Range on the West. There is a thrust fault zone, not a single fault plane, along the west side of the bottom of the Spray Canyon at the dam. The strike of the strata corresponds closely to the trend of Spray Canyon, about N. 45° W. The older strata west of the fault zone, consist of limestone, dolomitic limestone, quartzitic sandstone and some shale, of the *Rocky Mountain* formation, of Carboniferous age, with an average dip of 68 degrees to the west, have been thrust eastward over the younger strata in the east side of the canyon. The strata under the floor of the canyon consist largely of interbedded shale and limestone. In the fault zone the strata have been brecciated and recemented. On the east side of the canyon interbedded silty and tufaceous limestone and dolomite with some porous beds and cavities filled with limey clay, dip 65 degrees to the west. The permeability is low and the cavernous beds are not continuous. The diversion tunnel is located on the east side of the canyon.

The glacial history along the Spray development is varied but not complex. The valleys have been widened, deepened, and rounded by valley glaciers. The Spray Canyon at the dam below about elevation 5,400 feet is post glacial and has been cut out by river erosion. The valley of the Spray at the mouth of the canyon south of the dam has been cut deeper than in the canyon by the valley glacier which flowed east under the present reservoir and down Goat valley towards Banff. The floor of the canyon at the dam is "hanging" above the floor of the canyon at the confluence of Spray River and Bullet Creek, now flooded.

Concern was felt during the exploratory drilling over the fact that several of the holes struck artesian water. One of these had a flow of about 30 gallons per minute, under a static head of thirty-five feet. Once the floor of the canyon had been stripped and cleaned, many springs

Fig. 5. Goat Dyke and Sidehill Canal. Cleft in the range is Whiteman's Pass.

appeared. However, close observation of the springs and weeping drill holes as related to the elevation of the water behind the cofferdam indicated that there was no direct connection between them and the water in the river. Before the construction of the core began, the larger of the springs were collected in finger drains built of graded sand and protected by a shell of cement mortar. These were extended to a sump at the downstream edge of the core. From this point the water was taken away in two six inch pipes to the toe of the dam. These finger drains collect the water from all of the core zone, except that portion lying upstream of the middle third of the core zone. Upstream of this limit sixteen inch diameter pipe risers were placed over each of the springs, of which there were seven, and the water was kept down in the risers by pumping continuously. As the core of the dam grew in height, lengths were added to the risers, until the water in them ceased to rise any further. The risers were then filled with puddled clay. Only one out of the seven springs thus controlled broke out of the pipe and formed a soft spot in the fill. This was repaired by installing a new riser at the soft spot, and hand tamping clay around it until the fill was again firm. Observations of the six inch pipe drains at the toe of the dam have shown a constant flow of about 150 gallons per minute since the reservoir was filled. There is very little change in this discharge with the reservoir drawn down.

Diversion of the river was made through a tunnel in the east wall of the canyon, 1,030 feet in length, and 16 by 16 feet in cross section. Due to the short time available in which to prepare the river bed for the placing of the core, the excavation of over-burden was done during the winter, at the same time as the diversion tunnel was being driven. As the winter advanced, the banks were cleaned of over-burden, and a great deal of the gravel in the river bed was dredged out under water, by means of draglines.

The winter flows are very low, ranging from about 100 c.f.s. in January to a minimum of 60 in April. This fact greatly simplified the cofferdam problem. Actually no regular cofferdam was ever built. Instead, the first operation was the excavation of a trench in the river gravel extending from bank to bank just upstream of the line of the upstream toe of the dam. This trench was to form a cut-off and, therefore, extended to bed rock. It was then backfilled up to the original river bed level with impervious till. Two 48 inch diameter corrugated iron pipes were then laid in a trench parallel to and about twenty feet west of the river. This extended from the upper end of the clay filled excavation about 240 feet downstream. The capacity of these two pipes was sufficient to pass the anticipated winter flow of the river. The river was then forced into the pipes by building a fill across the stream. This fill was then built up to such an elevation as to permit the spring floods to be carried by the diversion tunnel without overtopping. This cofferdam fill was made impervious by facing it on the upstream slope with compacted glacial till. This was lapped over and formed a continuous impervious membrane with that previously placed in the trench in the bottom of the river. The fill was so located as to become a part of the completed dam. Once the diversion tunnel was completed the 48 inch pipes were plugged, thus diverting the water into the tunnel.

The diversion tunnel was designed to also serve as a means of discharging a limited amount of water down the bed of the Spray should this be required by the National Park Authorities. An adit was therefore driven giving access to the tunnel from a point about sixty feet higher than the main entrance portal, and joining the tunnel one hundred and eighty feet from the portal. This junction was also selected as the site of the permanent tunnel plug which was to be placed once the dam was well on the way to completion. No regular closure gate was provided, but on the floor of the tunnel, at the junction with the adit, a low concrete dam was built. This contained two three by five foot passages equipped with steel flap gates at the upper end. During the summer high discharge period, the water flowed over this structure, as well as through it. Later in the summer, the flow could pass through the openings leaving the top of the structure above water. Then, the final concrete plug could be built on top of the low dam, after which closure could be effected by closing the flap gates by means of tackle installed for this purpose. Actually, the operation did not go quite according to plan. Due to various reasons it was decided to hasten the closure of the tunnel, and the construction of the plug was attempted with water still flowing over the low dam. During this operation, a carpenter fell off the structure and was drowned. Some misgivings were also felt about the reliability of the tackle meant to close the flap gates after the plug was built. And so, therefore, in order to permit closing the plug in the dry, a timber sluice structure was built through a road fill which crossed the river upstream of the dam. Thus, means were now available by which the river could be shut off for short periods, since several hours storage were available behind this improvised dam. The closure of the tunnel plug was now a simple matter.

As the rock in the tunnel was poor

containing several seams which were not entirely water-tight, it was decided to build a fill over the entrance, in addition to the concrete plug farther in. This was only partly successful, as the necessity of building this fill ahead of the rising water did not allow sufficient time to compact it. Consequently, after it was submerged, it slid down, exposing the top of the portal. More material was added, under water, but the greater part of this also slid out into the canyon. Two pipes equipped with valves and with a pressure gauge had been left through the concrete plug, and these provided a means of determining whether the fill covered the portal effectively. During the ensuing winter, constant observation of these pipes led to the conclusion that the fill did not adequately plug the entrance. By means of a long tremie, suspended from a raft, and located directly above the tunnel entrance, further clay was placed, which succeeded in partly plugging the opening. As it stands now, the pipes through the concrete plug are left running, and there is sufficient restriction provided by the clay at the entrance to keep the head on the concrete plug down in the neighbourhood of 50 feet. At first, if the valves on the pipes were closed, the pressure rapidly rose to that corresponding to the full static level of the reservoir. Lately, probably as a result of consolidation in the plug, there is less evidence of such rise in pressure.

As mentioned before, the concrete plug was located at the junction with the adit. At the top of the adit, a small intake structure was built containing trash racks, and a steel emergency flap gate. This led to a three foot diameter steel pipe solidly concreted into the adit. It passed through the tunnel plug and terminated in a thirty inch gate valve. Thus, means of by-passing a small quantity of water was provided.

Little need be said of the construction of the dam itself. With good weather, readily accessible borrow pits. and excellent organization by the contractor, the dam, which contained slightly over one million cubic yards of material, was completed in five months.

Three Sisters Dam

The Three Sisters Dam, at the North end of the reservoir is also an earth fill structure, 2,200 feet in length, and containing 350,000 cubic yards of material. Borings in the area of the dam failed to disclose bed rock in a depth of 100 feet. The valley was found to be filled with glacial till, overlain by river gravels and sand, in thickness up to one hundred and ten feet, interbedded with several bands of compressible silt. One silt lens seventy-five feet below the surface is twenty feet thick, and its presence indicated that settlements up to 0.9 feet could occur at the centre-line of the dam in the section containing the outlet works. The gravels above the silt are open, and extensive seepage was to be expected.

The design of the conduit carrying the water from the reservoir through the dam was, therefore, influenced by the condition that settlement could occur. It was decided, after considerable study, that a mild steel pipe 10 feet in diameter, provided with suitable type of expansion joints would be the least likely to give serious trouble. Careful protective treatment to the outside of the pipe would reduce the rate of corrosion, which, experience has shown, can be considered almost negligible in the cold mountain waters. The type of joints used are shown in Figure 13. The pipe was to be laid directly upon the bottom of the trench excavated for the purpose, and backfilled with compacted material. Extensive cut-off provisions were incorporated in the concrete intake structure. This was completely surrounded with carefully compacted inpervious material, lapped well over the upstream concrete apron and connected to the blanket extending upstream from the dam. Approximately midway along the length of the pipe is a cylindrical steel and concrete tower which contains the head gate and its operating mechanism. There is no means of access to the portion of the pipe upstream of this tower, except when the reservoir is nearly fully drawn down. As the head gate was to be used for throttling and controlling the discharge at times when the by-pass around the turbine was

Fig. 6. Looking south into Whiteman's Pass from Bow Valley. North dam in bottom of upper notch. Access road on the right. Spray powerhouse at the bottom of the picture. (Note transmission line.)

Fig. 7. Spray Canyon; January, 1949.

in use, there was the possibility of a standing wave occurring in the pipe below the gate. It was thought that the unstable condition resulting from it might cause serious vibration in the pipe, even though the latter was buried in a compacted fill. As a safeguard against this, three heavy, reinforced concrete collars were poured around the pipe below the gate, fifteen feet apart. Other than these, there were to be no supports under the pipe. However, it was found, on excavating for the powerhouse sub-structure, that due to excessive water it was expeditious to raise the proposed powerhouse elevation by two feet. As a result, in order to keep the pipe on a level grade, it was necessary to raise it also. The trench for the pipe had already been excavated to the original grade elevation, and the proper procedure would have been to backfill up to the revised invert elevation with thoroughly compacted material.

However, due to a cold, late spring, and to the rapidly rising reservoir, there was not sufficient time to do so, and so the pipe was erected on small concrete saddles and the backfill compacted as well as possible under the pipe. This was entirely inadequate and by the time the earth dam was nearly completed, the material beneath the pipe had settled enough to transfer the weight of the pipe and its surcharge of earth to the concrete saddles. This produced large "blisters" in the pipe invert. At the same time the pipe became elliptical, movement took place in the sliding joints, and some buckling occurred in the plates forming the transitions from the pipe to the gate tower. Test holes cut through the invert disclosed a void under the pipe, up to three inches in depth. Although evidence pointed to the likelihood of further settlement taking place, immediate action was necessary. So the underside of the pipe was cement-grouted through nipples welded into the invert. At two places where the supporting concrete piers had seriously deformed the invert, the damaged sections of plate were cut out, the concrete chipped down the necessary amount, and a patch welded over the hole. Bellows-type corrugated sleeves made of very mild steel were welded over the inside of the joints, thus supplementing the sliding joints which had been built into the pipe, and which, in some cases, had ceased to be effective. Fears that these sleeves might eventually tear off with the passage of the water through the pipe were unfounded. They have stood up well, have even undergone without distress some movement of the pipe.

As the water in the reservoir rose, there was a general rise in the water table downstream from the dam which resulted in seepages appearing on either side of the powerhouse substructure. There was also evidence of saturation of the material under the pipe. It was thought that possibly the settlement of material under the pipe was opening up a path of percolation where piping might develop. As a precaution it was decided to pressure grout the underside of the pipe. As the part of the conduit upstream from the gate was by now submerged and impossible to unwater, churn drill wells were sunk on either side of the penstock from elevation 5565, and grout injected into the holes. Whether or not the grouting produced any results was never definitely known, but migration of grout for a distance of twenty feet, from one side of the pipe to the other was observed. No further measures were taken in 1950. It has been well established that no movement of water did occur along the pipe.

The anticipated settlement, due to the underlying silt, proved to be

Fig. 8. Mr. Patrick Harrison, the author, Mr. George White of Foundation Company of Canada, and Mr. A. Judson, travelling superintendent.

negligible. The distortions in the pipe were the result of consolidation of the underlying backfill. This consolidation also caused the transition sections at the gate tower to buckle.

Due to delays in other sections of the project the development was not put into operation in 1950. During the winter, water stored in the reservoir was released through the pipe and powerhouse by-pass, making it possible, by spring, to inspect the upstream section of pipe. Further settlement of the underlying fill had occurred, resulting in the buckling of the first joint upstream from the gate tower, to such an extent that the plates had ripped apart. The torn plates were cut out and patches welded in. In order to fill the void under the pipe, extensive grouting was done, both through the invert of the pipe and through wells bored from the surface on either side of the pipe. Inspection of the pipe cannot take place again until the spring of 1953, when the reservoir will again be sufficiently drawn down.

At the powerhouse, the pipe branches into a symmetrical Y, one leg feeding the 3,600 horsepower turbine, and the other being the by-pass which discharges, through a diverging tube, into the tailrace. Due to the possibility of settlement, the powerhouse was built on a raft foundation, reinforced to ensure settlement as a unit. After the substructure was completed, concern was felt about the possibility of subsurface erosion beneath the building. There was a large volume of seepage appearing in the slopes of the tailrace cut on either side of the powerhouse, and especially at a low elevation adjacent to the building itself. This seepage, it was believed, was augmented by the fact that there was a heavy run-off. This raised the water table well above the bottom of the tailrace cut, but it was not possible to determine, even closely, how much of the water was coming from this source. There was also some from the reservoir, through the gravels under the dam, and possibly through the cut in which the pipe was buried. As a safeguard against movement of fines, a thick inverted filter was placed in the tailrace downstream from the draft tube. The filter was graded from sand at the bottom to heavy rip-rap at the top. In addition, the powerhouse was surrounded by a closed curtain of steel sheet piling about twenty feet deep driven as near to the building as a piledriver could operate. The space between the sheet piling and the building was filled with concrete, care being taken to prevent the concrete from bonding to the sheet piling. Two inch diameter grout pipes were left projecting up through the concrete slab at ten foot intervals all around the building, and extended well underneath the foundation. The purpose of the sheet piling was to divert any flowing water from beneath the powerhouse, where it might conceivably start erosion of the finer material. The purpose of the grout pipes was to provide some means of

Fig. 9. Construction of the Canyon Dam.

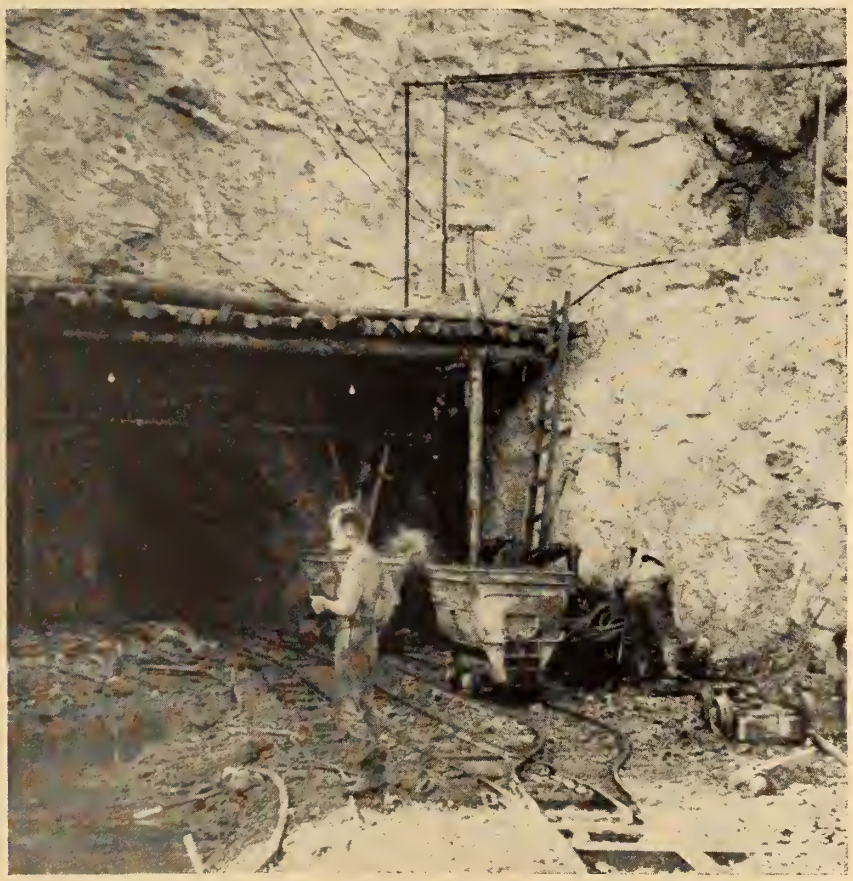


Fig. 10. Exit of Spray pressure tunnel at the site of Spray powerhouse.

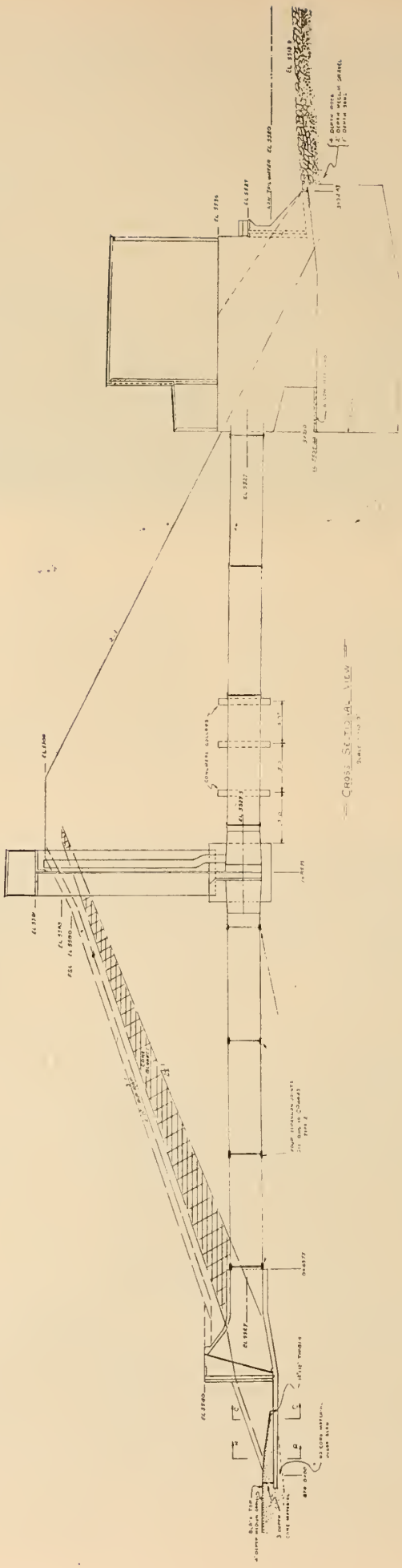


Fig. 11. Cross section of Three Sisters Dam showing conduit, intake works and powerhouse.

righting the building, should any settlement occur. This would be done by injecting grout under whichever section had settled the most.

Thus far, the powerhouse and surrounding area have behaved well. The grout pipes have been used only as wells for observing the height of the water table beneath the powerhouse.

The dam was designed to have an impervious blanket on the upstream face, the remainder of the embankment being of pit run material more or less pervious. The impervious blanket was to extend upstream from the dam, covering the gravel floor of the valley for a distance ranging from 200 to 1000 feet. However, in the course of excavating the intake canal, a deposit was found which had a lower permeability than that of the available blanket material. The greater portion of the dam was, therefore, built as a nearly homogeneous dam, using this material, care being taken to place the finer portions in the upstream half and the coarser in the downstream. Only the portion of the dam adjacent to the intake structure and pipe was built according to the designed cross-section. On further examination of the area and because the water rising in the reservoir was rapidly approaching the base of the dam, it was decided that the extent of the upstream blanket should be considerably reduced. As a result, no blanket was built on the western one-third of the area adjacent to the dam. As the underlying soil consists mainly of open, free draining gravel, providing a natural drain for the toe, a gravel facing and toe drain were considered to be unnecessary features.

During 1950 the water in the reservoir rose to elevation 5569. Considerable seepage appeared along the toe of the dam, and a few wet spots showed up on the downstream face. The flow in the tailrace channel, from seepage and natural drainage of the mountain slopes reached a maximum of 40 c.f.s. one hundred and sixty feet from the powerhouse. When the cold weather arrived all these manifestations either diminished or disappeared.

In 1951, a high run-off year, the reservoir level rose to the normal full supply of 5583. As the water rose, seepage at the toe increased rapidly and numerous small boils erupted in the area extending from the toe of the dam, downstream for a distance of one hundred and fifty feet out. Again, wet spots appeared high on the face of the dam, which, at a few places, became soft, with

some sloughing of the surface. A facing of coarse fan material was then placed on the face of the dam, reducing the downstream slope from 3:1 to nearly 4:1. This effectively stabilized it, although water persisted in coming out to the surface at a slow rate. The boils in the level area at the foot of the dam were covered with a ballast of clean gravel two feet thick. Not only was the entire area stabilized, but also the total seepage from these boils appeared to be reduced. This apparent reduction in flow could, of course, have been the result of a general lowering of the ground water as the summer advanced and which may have coincided with the placing of the gravel ballast. While seepage into the tailrace canal 600 feet below the dam is of the order of 100 c.f.s., including subsurface drainage from the mountain slopes, no concern is felt for the safety of the structure. At no time was there ever any sign of dirty water, or of particles of soil being transported.

This dam is built across a valley two thousand feet wide. The floor of the valley consists of extensive beds of clean sand and gravel, which reach several thousand feet upstream of the dam. It would indeed be surprising if there had not been a large increase in the volume of ground water below the dam. The dam being on a gravel foundation, there is no problem of stability. The water seeping through, passes on down to Goat Pond, and from there into the main canal.

Goat Pond and Sidehill Canal System

The water from Three Sisters is carried in a tailrace canal 1½ miles long, into Goat Pond. Goat Valley is two thousand to three thousand feet wide, and has been rounded by a valley glacier which flowed towards Banff and with a branch flowing East through Whiteman's Pass to the Bow. When the glacier melted from the Goat Valley, deposits in the form of ground moraines and glacio-alluvial flood plains partially sorted by water accumulated in the valley. These partly sorted deposits are lensy, but nevertheless are porous and permeable in many places.

During and after the glacial stage alluvial fans and talus fans were built up along the sides of Goat Valley. These fans are all more or less pervious.

In a distance of about 8,000 feet northwards from Three Sisters Dam, the floor of the valley drops only twenty feet. Beyond this, the gradient steepens, averaging about fifty feet per mile to the junction of Goat Creek with the Spray River, about seven miles above Banff. At a point directly opposite Whiteman's Pass, the valley floor is 200 feet lower than that of the Pass. A canal designed to carry water from Goat Pond into the Pass must, therefore, follow a route whose elevation becomes progressively higher above the valley floor. The valley being roughly U-shaped in section, the slope of the ground transverse to the line of the canal becomes progressively steeper. This fact determined the upper limit in the selection of the canal elevation.

Whiteman's Pass, through the Rundle Range, has been cut by a small valley glacier moving eastward from Goat Valley into Bow Valley. The Pass at the North Damsite is glacier-cut down to elevation 5,450 feet. Evidence of the glacial action at this point is contained in three small water-worn moulins, or glacial mills, formed by water and gravel falling through a crevasse near the edge of the glacier. The rock here is a massive dolomitic limestone.

Goat Dyke is located at the point where the valley gradient steepens. The valley is filled with glacial debris irregularly sorted by water as at Three Sisters. This porous material outcrops in the centre, but is covered by a thin layer of silt near the foot of either range of mountains. This provides a more or less impervious blanketing of the gravel, over about one-half of the width of the valley. Thus there was little chance to build a tight structure here. Unfortunately, the need for a tight dam is greater here than at Three Sisters. Any water lost from Goat Pond cannot be recovered except by pumping back into the main canal. It had been planned to build a moderately extensive clay blanket upstream from the dyke. However, during the 1950 construction season heavy run-off from the headwaters of Goat Creek, plus the leakage from Three Sisters caused most of the area above the dyke to be submerged before the blanketing could be done. When the pond was filled, considerable seepage appeared at the toe of the dyke, and in the woods downstream. In the spring of 1951, the blanket was extended by dumping fine material along the shoulder of the dyke, and bulldozing it as far into the water as it was possible to do. This served to reduce the visible seepage to a small amount in the area immediately below the toe, but the banks of the creek and an extensive area below the dyke have broken out into numerous springs, which, in December 1951, had a total discharge of 48 c.f.s. This seepage is thought to be due to a general saturation of the gravel by water entering the many places in the pond where there is no impervious cover over the gravel, and possibly also for a great distance back along the tailrace canal, towards Three Sisters. This situation will take time to correct, as the opportunities for unwatering the pond are rare, and the area to be blanketed is large and difficult of access. However, as a result of some tests, confidence is felt in the effectiveness of a silting program, to be carried out on a small scale over a period of several seasons.

Goat Pond flows into an earth canal 15,000 feet long designed to carry 700 c.f.s. with a maximum velocity of 1.6 feet per second. The canal is built along the side hill whose slope transverse to the axis of the canal varies from zero to 22 degrees to the horizontal. In addition

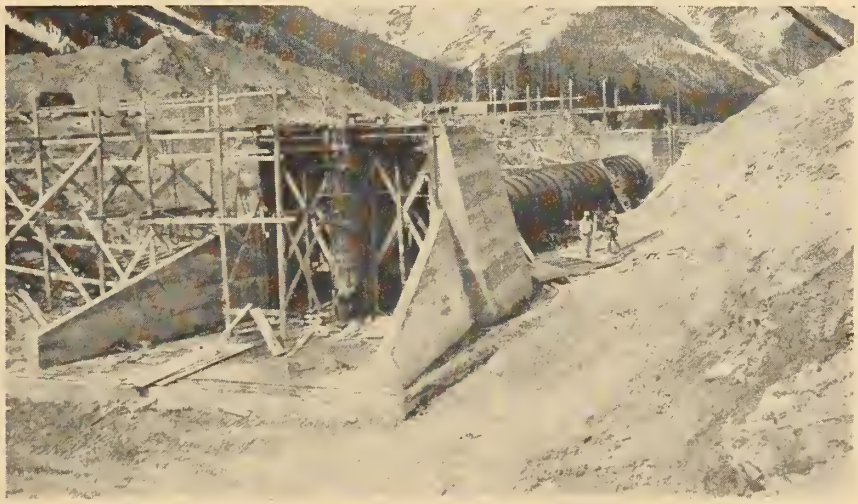


Fig. 12. Three Sisters conduit, with intake structure in the foreground.

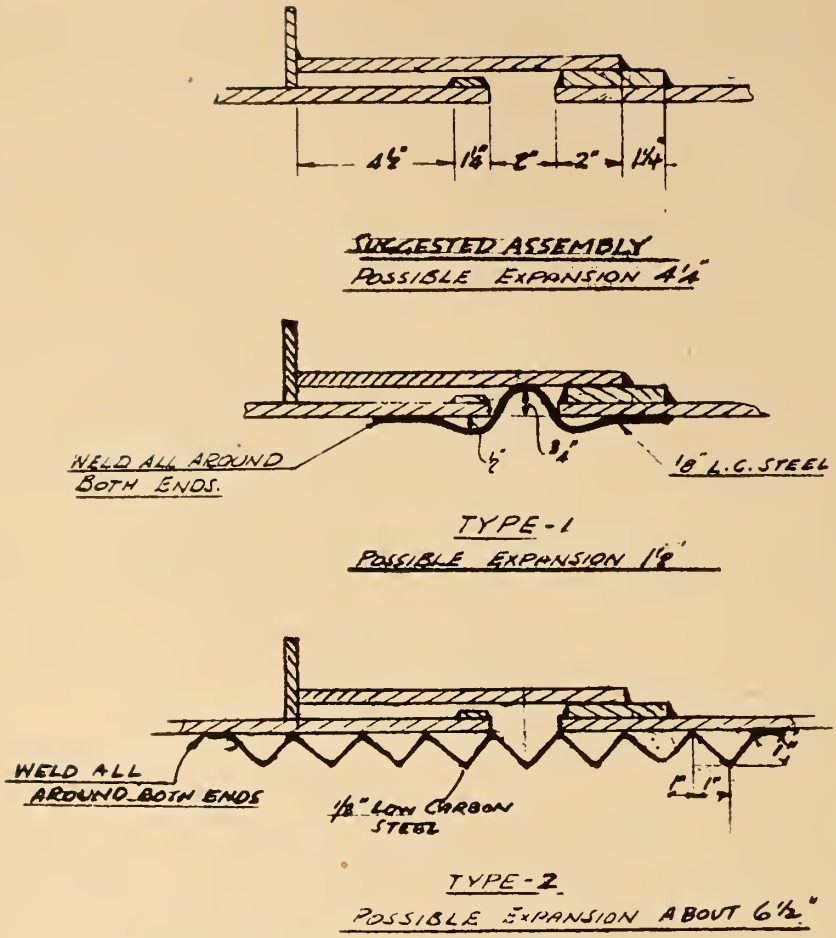


Fig. 13. Details of joints in Three Sisters conduit.

to fan material and glacial till previously mentioned, the route to the canal crosses sections of coarse limestone talus and ridges of solid rock. As first evaluated from observation of testpits and percolation wells about 5000 feet of canal route was considered to be sufficiently impervious to not require lining. 2000 feet were doubtful, and the remainder was in porous ground requiring lining.

The last 1700 feet of canal was built in talus at the foot of a vertical rock face at the entrance to Whiteman's Pass. The talus in its original state had a slope of 1½ to 1, and consisted of broken limestone fragments ranging in size from sand to "Floaters" of fifty cubic yards or more in volume, all very angular in shape. The structure of this talus material was very stable. The canal excavation was formed by removing all talus material lying above the elevation of the canal embankment. That material was used to widen the bench thus formed. The canal prism was then excavated in this bench, the uphill side of the prism being the solid rock slope of the mountainside. The bottom of the canal thus built was about forty feet above the flat, or gently sloping ground beyond the toe of the talus. In order to make this canal impervious a compacted clay lining was applied to the outer slope and the bottom, and in a five foot thick fillet along the rock slope. The remaining pervious sections of the canal were lined with glacial till.

In general, the lining of the canal was placed by spreading, to a depth of two feet down the slopes and across the bottom, with a bulldozer. It was then compacted with a standard sheepsfoot roller pulled up the slope by the drag cable of a dragline stationed on the canal embankment. All compaction was closely supervised, and controlled by frequent tests. Sections of the canal which were considered to be sufficiently impervious were left unlined. In other sections, the lining extended up from the bottom only a short distance to cover over layers or lenses which were known to be pervious.

Early in November, 1950, water was admitted to the Canal. Numerous leaks appeared, both in the lined and unlined parts. Some leaks were at the toe itself, and others in the form of springs, as much as five hundred feet away from the canal. Most of these leaks produced clean water, the notable exception being the talus section and at the entrance to Whiteman's Pass. Here many large, muddy springs flowed from the toe, and also from high up the slope of the embankment. The discharge must have totalled about 25 c.f.s., from a length of canal of sixteen hundred feet, and appeared to be increasing. The water was, therefore, shut off. As a result, the level of that in the canal dropped slowly. Attempts were made to plug the leaks, where the point of entry could be seen, with additional clay. The primary cause of these leaks lay in the fact that there was a steep gradient at the end of the canal where it discharged into Whiteman's Pass. Until the pond in the pass had risen to the elevation of the canal, the velocity of the water was suficient to erode the clay bottom. There being no control structure at the outlet of Goat Pond other than a temporary low dyke, control of the flow was difficult. Thus, a great deal of lining was damaged before the canal was even filled. Another region of heavy leakage was the contact between the steeply sloping rock cliff and the five foot fillet of clay. During attempts at repairing the lining it was found that this fillet resisted all methods of staunching. The fines were carried down the slope of rock almost as fast as they were placed.

On November 25th, during the lunch hour, the talus canal failed over a length of 800 feet. The arc of failure followed down the face of the solid rock, then through beds of fine quartz & limestone sand & silt sixty feet below the canal bottom. It followed these beds and intersected the surface of the ground some three hundred feet from the toe of the embankment. In the area where there had been a small creek draining the Pass, the movement of the base of the slide was horizontal, and great masses of talus were found to be frozen in a state of permafrost. The underlying fine, uniform material had liquefied, carrying for at least two thousand feet like so many icebergs, the great blocks of frozen talus. Beyond the South end of the slide, and out of the creek bed, a road and telephone line which had been parallel to and about one hundred feet away from the embankment were moved laterally without complete disintegration a distance of seventy-five feet. Trees also, were shifted, standing up, as though on a conveyor belt. As the

disaster occurred during the noon hour, machinery was in the area, but no witnesses were there, One tractor, however, had been left with the motor idling, on the embankment, and it was carried down and engulfed in the mud and water at the foot of the mountain. An estimated 180,000 cubic yards of earth and rock were shifted.

The slide can be classified as a "flow slide". These characteristically develop in wet silt, and at the instant of failure the load is transmitted entirely to the water phase of the soil mass, which then behaves as a heavy liquid, and moves out as a liquid mass until the pore pressures are reduced to the extent that the load is again carried by the soil skeleton. The fact that it was a flow slide is best illustrated by the tremendous distance that material moved down the creek bed.

In any slide there must be a source of water. In this case the origin of the water was the leakage from the canal and also leakage from the rock, which only became apparent after the slide had occurred. The silt which finally flowed is so impermeable that water will flow out of it very slowly. Water leaking into such a mass gradually builds up hydrostatic pressure, and eventually the point is reached where any slight disturbance will cause failure, or, for that matter, it can occur due to the excess hydrostatic pressure in the water phase which finally reaches the point where the shearing resistance of the mass is just great enough to carry the surface superimposed load. As soon as any slight deformation occurs in such a mass it reverts to a liquid condition.

It is not likely that the permafrost which existed in the talus was a contributing factor. It was not known that the talus was underlain by fine uniform silt, nor was it known that water was seeping from the rock into this silt at some distance below the surface of the talus. During the exploratory phase of the project it was not thought necessary to sink deep holes in the talus, as diamond drill boring in the mouth of the pass immediately adjacent to the slide area had not disclosed any silt.

In view of the presence of additional beds of this sandy silt brought to light by the slide, it was decided that it was not practical to rebuild a canal here. Furthermore, it was now winter, and it was not possible to rebuild the broken section of canal in time to put the plant into operation when required. As a temporary expedient, to relieve the acute power shortage which was threatening, a timber flume was built, which was anchored to the rock cliff and spanned the breach. As no such structure could withstand the shower of heavy boulders and rock fragments which regularly rained down the mountainside during the spring thaw, the flume was therefore to be replaced by a tunnel. This was to be driven before spring, through the rock spur forming the gateway to the Pass.

The flume, containing six hundred thousand board feet of lumber, was completed and put into operation one month to the day after the slide had occurred. However, during that month, the canal had of necessity been empty, and was thus exposed to the frost, which penetrated one to two feet into the banks. Where the canal was in naturally impervious ground, this was of no importance, but where it was lined with a two foot thickness of glacial till most serious trouble developed. Upon refilling, the submerged lining thawed and slumped slightly, whereas that above the water line remained frozen and unyielding. This produced, at the water line, something very much like the eave of a roof, having beneath it a breach in the lining. This condition extended over several thousand feet of canal, and it became an unceasing battle, using clay and sandbags to prevent these openings from becoming uncontrollable pipes. At the same time, serious leakage developed at a section of canal which was partly in rock and partly in earth. The seepages took place along the plane of contact between rock and earth, penetrating into and saturating beds of fine sand 75 feet down the hillside, below the toe of the embankment. Sloughing resulted, which threatened the canal with failure. The canal was therefore again emptied after a week, and the rock cut section was bolstered up with about 40,000 sand bags and puddled clay. All the while, there existed a serious shortage of power in Alberta, and the repair operations were carried out under the great stress of urgency, in bitterly cold weather. Simultaneously with the sandbagging operation, all visible leaks were being patched with more clay.

The canal was again filled on January 17th, in sub-zero weather. The sandbags had been of some value, but trouble developed again with sloughing of the thawed lining. Despite valiant efforts on the part of a large crew of men, during the night of January 27th, with the thermometer at 35 degrees below zero, one bad leak went out of control. Soon it was piping muddy water at the rate of 100 c.f.s. The discharge was further increased by the fact that the passage eroded under the frozen shell of the embankment and formed a siphon. Thus encouraged, 500 c.f.s. were soon spouting out of the hole. An hour or two later, the frozen roadway on the crest of the embankment collapsed, and by daylight the gap had grown to a canyon seventy feet wide and fifty deep. It was then reluctantly realized that no method was known whereby the lined canal could be made to hold water when filled while in a frozen condition, and all efforts to put the

Fig. 14. Spray powerhouse.

Fig. 15. 62,000-horsepower turbine runner.

development into operation before summer were abandoned.

The problem of rebuilding the canal into a reliable water-carrying channel was divided into three parts. First was the rock section, where the trouble had been at the contact between the rock and the overlying earth. Here, too much faith had been placed in the tightness of this contact, and in that of the rock itself, which did contain some bad fractures. These, in themselves, were of no great importance, but the fact that they permitted the water to enter and disturb the very unstable sand below the canal constituted a grave threat to the safety of the embankment. The danger was further increased by the height of the embankment, and the sloping ground below it, which together amounted to nearly one hundred feet of slope averaging about 2:1. The method of repair proposed was the building of a concrete, gravity type wall upon the rock, which would take the place of the embankment, and would therefore eliminate the stability problem. However, once the canal bank was excavated, and weathered rock was removed down to solid, the height of the proposed wall was much greater than anticipated. The resulting expenditure being excessive, this scheme was abandoned. Instead, a concrete cut-off wall two feet high was built upon the rock for the full length of the cut. The rock, for a distance of eight feet on both sides of the cut-off was covered with gunite. The gunite also extended twenty inches, on expanded mesh, up on the slope of the excavation. This provided a sort of flashing to discourage the water, which might percolate through, from finding its way back to the rock-earth contact. The cut-off was then buried in a carefully compacted core of glacial till which extended up to the top of the embankment on a 2:1 slope. Where vertical transverse fractures crossed the canal, some pressure grouting was done, but little penetration of the grout was obtained. The uphill side of the canal was also gunited where thought necessary. At either end of the cut, where the rock-earth contact crossed the bottom of the canal, the concrete curb was carried down the slope of the rock to an elevation where its top was ten feet below the bottom of the canal. It was then extended across the bottom at this elevation and up the slope of the rock to the water line. In addition, a second cut-off was built six feet above this. The ten foot depth was then backfilled with clay. These elaborate provisions were felt to be essential to produce an adequate length of percolation path. In order to increase the stability of the embankment, a very heavy gravel toe was built on a 3:1 slope, and the upper 40 feet of the canal embankment was flattened to a slope of 2½:1. These provisions have been very successful in reducing seepage. Had a full-height concrete wall been used, the cost of maintenance and repairs would probably have been high, due to frost action at the water line.

The second problem was the repair of those sections where leaks had occurred through the clay lining. Many of these leaks were the result of frost, but in other cases the water ran out through holes which appeared in the lining after filling the canal. The lining material was a glacial till with particles ranging in size from small boulders to rock flour, with seventy-five percent retained on a 50 mesh sieve. Even though inspection was careful, it is conceivable that pockets of two or three stones up to 6 inches in diameter could occur. In such cases the effective depth of the lining would be only 6 to 12 inches. Where there exist ample fines in a soil, funnel-shaped holes such as those found in the floor and slopes would probably staunch themselves. But, in this case, the fines in the immediate vicinity of the holes were soon sucked in, leaving only clean sand and gravel through which the water passed readily. Furthermore, it may be that, for a lined canal passing through porous ground, a considerable amount of the lining particles eventually find their way into the voids of the underlying material.

As the canal prism was designed to carry a given volume of water with a given head loss, the lining could not be greatly thickened without adversely affecting these hydraulic properties. Re-excavating of the entire canal was out of the question due to cost and to the short time available. Therefore, only a few sections were re-excavated, and in the remainder of the canal to be lined individual holes were repaired by hand, a small amount of additional lining being applied, and the entire lining re-compacted thoroughly. Most sections of canal which had

originally been unlined were now given a lining.

The third problem was the treatment of the approaches to the tunnel which had been driven around the slide area. The upstream portal headed into the rock cliff, whose slope normal to the tunnel axis was about 2:1 except immediately below the tunnel invert, where it was vertical. The difficulty, here again, was to make the contact between this rock face and the canal lining tight. The floor of the canal was, therefore, excavated to a depth of fourteen feet below the tunnel invert, and backfilled with four feet of compacted till. A horizontal concrete slab, twelve inches thick and eight feet wide, jutting out from the rock, thoroughly dowelled to the latter, and heavily reinforced, was poured on this backfill. At either end of this slab, where the slope of the rock was gentler, cut-off walls two feet high were poured, located 10 feet from the finished face of the canal lining and extending to the full supply level. Six feet above this cut-off system, another such wall was poured, thus joining a double labyrinth in the path of seepage. The excavation was then backfilled with compacted till, to the lines of the finished canal.

At the downstream portal, the rock was for the most part vertical, except for two sections where it overhung. The same method, using a slab anchored securely to the rock, was used and, where the overhangs occurred, a concrete fillet, with its outer face on a ¼ to 1 slope, was poured against the rock. Great care was taken to insure that the slab was securely anchored, as experience the previous year had shown that consolidation of the underlying material could occur and possibly produce settlement of the slab. These elaborate provisions, as well as those at the rock section of the canal have been very effective in preventing leakage.

The canal was rebuilt in sections, and, as each successive section was complete, the temporary dyke across the canal was removed, allowing it to fill.

Seepages occurred in numerous places, but all were clean, and some seemed to seal themselves after a few days. Others appeared from time to time, but none were considered to be serious enough to necessitate draining the canal. Those which broke out on the slope of the canal embankment were dealt with by building pervious facings to cover them. A drag, consisting of a twelve inch H-beam, rendered partially buoyant when under water by lashing 2 logs to it, was drawn broadside along the sides and bottom of the canal, stirring up the lining material, which was to some extent drawn down into the leaks, and reducing many of them. As the amount of fine material in the till was insufficient to produce a good mud, it was supplemented with some fine sandy silt dumped over the edge of the canal into the water. A great reduction in leakage was obtained quickly, and at very low cost, by use of this method of silting, and it was only suspended due to cold weather. The process is to be resumed as soon as the spring weather permits. The drag is so designed that when under water it exerts less than 1 pound per square inch of pressure on the canal bank, and it cannot dig into the material more than 1 inch. A dense cloud of muddy water follows in its wake, and the rapidity with which strong leaks dry up is remarkable. Pending the resumptions of this process, tremieing of clay into individual holes, from a boat, has been very successful. Holes are located by means of a powerful underwater lamp.

During the winter some sloughing occurred at two places along the hillside below the canal. Here the slope of the ground, including the canal bank, was of the order of 3:1. Repairs were effected by removing the soft material and backfilling with a gravel toe.

The average rate of leakage for the entire canal in December 1951 was 7 cubic feet per twenty-four hours per square foot of wetted surface. This rate is high, but confidence is felt in the possibility of reducing it to a small fraction of this by means of silting. One will appreciate the importance of reducing canal leakage, when it is considered that a leak of one cubic foot per second represents the loss of 100 continuous horsepower.

The experience gained in the construction of this canal was costly but valuable. The canal was built with side slopes of 2:1. It is felt that this is too steep for the type of lining material used. The lining did show signs of sloughing in some places, when the water was drawn down quickly. The spreading and compact tion were rendered more difficult and costly by reason of the steep slope. Considerable lining material was wasted as it tended to find its way to the bottom during the spreading and compaction. Two and one-quarter to one, or two and one-half to one, would have been a satisfactory slope.

The thickness of the lining was theoretically two feet. As pointed out above, this did not provide an adequate reserve of material to staunch the holes which might occur. Also, small inaccuracies in placing left too little margin of safety against patches where little or no effective lining existed. One deep cut of a bulldozer blade was sufficient to puncture the lining. While this glacial material, available in the area, was ideal for the construction of the core of a rolled earth dam it left much to be desired when used as a canal lining.

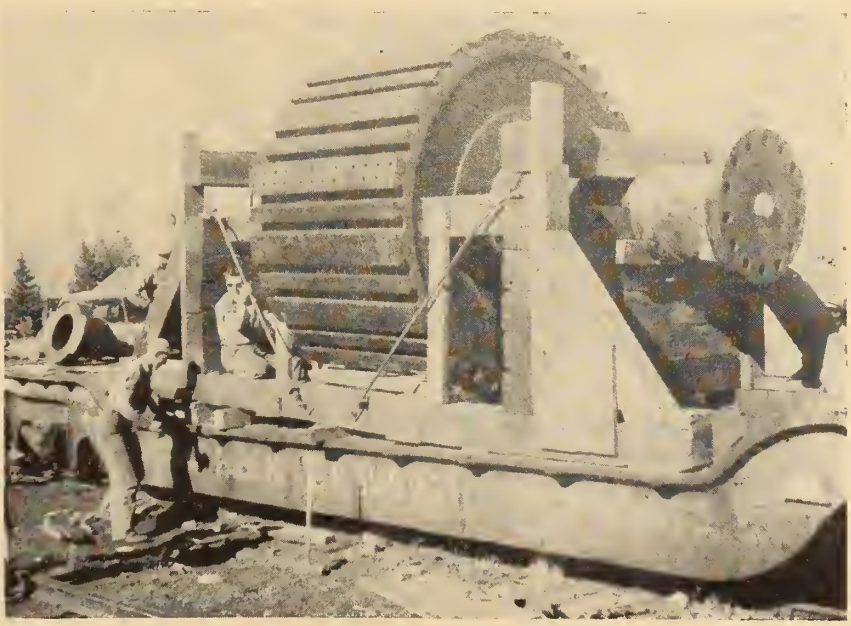


Fig. 16. Generator rotor without field poles.

The Pressure Tunnel

In the early stages of design, a steel penstock, on the surface, and, as an alternative, a concrete and steel lined pressure tunnel were considered as methods of bringing the water from the forebay in Whiteman's Pass to the Spray Plant. The factors favouring the steel penstock were speed of erection and known foundation conditions, as opposed to the uncertainties and hazards of tunnelling. Opposed to the penstock and favouring the pressure tunnel were:

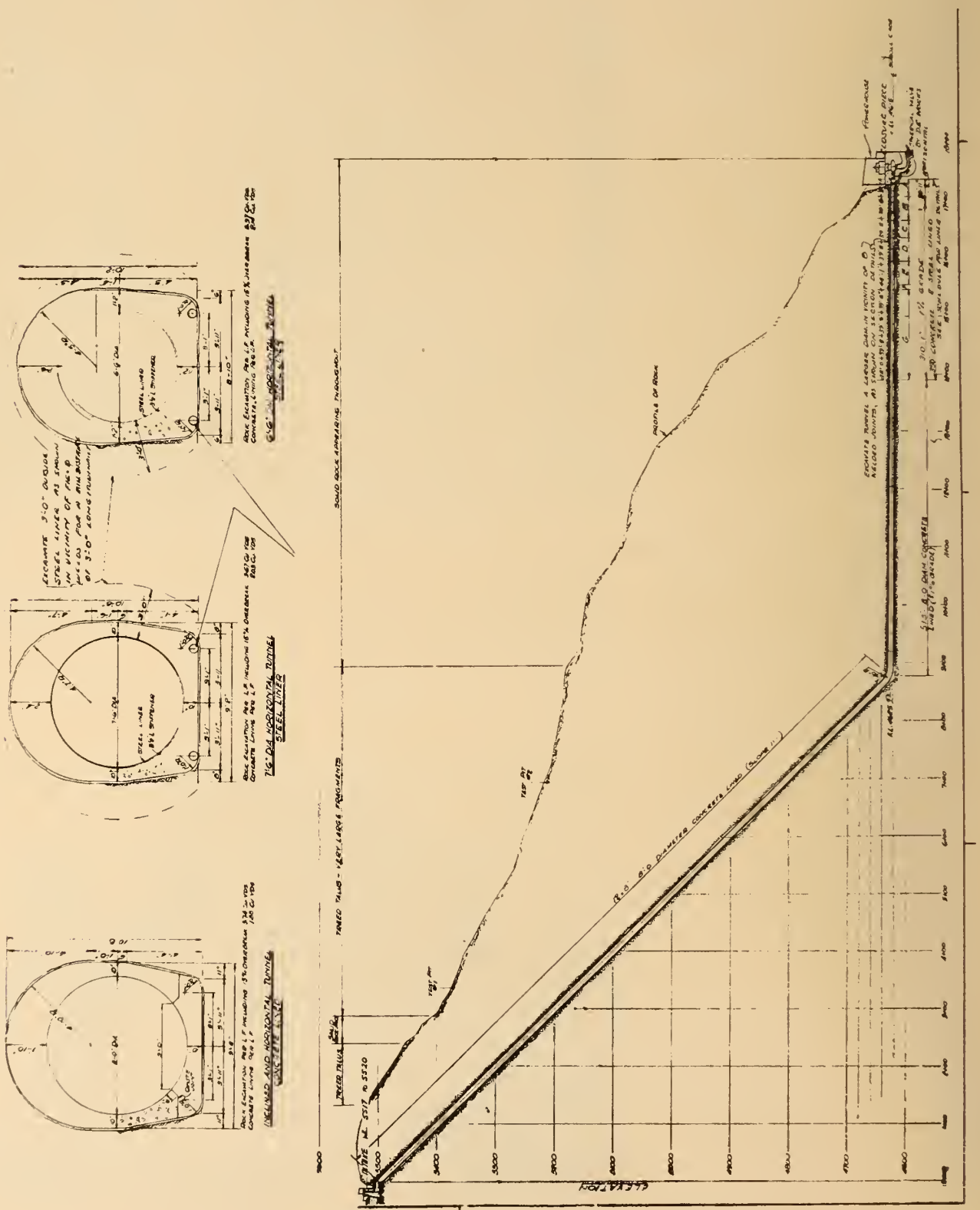


Fig. 17. Profile and typical sections of the Spray pressure tunnel.

1. The weathered condition of the rock along the line of the penstock would have necessitated several unduly large concrete anchors and paddles.
2. Low maintenance cost of a tunnel, as compared to that of a steel pipe.
3. Safety from rock falls and slides, in an area where the danger of such occurrences was serious, and to which a penstock would be vulnerable.
4. The tunnel required only a fraction of the steel needed for the penstock. This was a factor of importance at a time when steel supplies were not too good.

The estimated cost of each alternative was about the same, assuming no undue difficulty in tunnelling, which, in view of the excellent quality of the rock, was a reasonable assumption to make. The tunnel plan was, therefore, adopted.

The site of the tunnel is in a regular series of Middle Devonian strata consisting of massive, thick-bedded, and thin-bedded limestone, dolomitic limestone, some argillite and very few thin bands of shale. The strata have a general trend of 330 to 340 degrees and an average dip of 38 degrees west. In the tunnel the massive limestones between elevations 5,400 feet and 5,160 feet contain many vuggy cavities up to 10 inches in diameter, but this cavernous band is not permeable, as the rock is dry. This rock belongs to the Madison Limestone formation which is the oil-bearing horizon in Turner Valley.

The site chosen for the Spray Plant was 1800 feet, horizontally, from the intake, and was at Elevation 4,605 feet or 905 feet below the intake. Starting at the powerhouse the tunnel penetrated on a 1 percent grade for a distance of 915 feet, then it rose on a 45° slope for 1,250 feet, emerging at the end of the short canal leading from Whiteman's Pond. Originally it had been intended to carry the drift to a point vertically below the intake, then to drive a vertical raise. However, the tunnelling contractor felt that the inclined raise was quite feasible, and, as it resulted in a reduction of 500 feet in the length of tunnel, the inclined raise was adopted.

The tunnel was to be lined with concrete from the intake down to a point where the rock cover was insufficient to resist the stresses resulting from hydrostatic plus surge pressure.

Design of the steel tunnel lining was approached from the point of view that there was a certain thickness of rock cover which was sufficient to withstand the pressure of the water in the tunnel. Where the thickness of rock was less than this critical value, a steel lining was required which would share the load with the surrounding rock.

The computation of the stresses in the rock, where no steel was required, are as follows:

Head: 900 feet plus 35% surge = 1220 feet.

Equivalent water pressure: 76,300 pounds per square foot.

This is a radial pressure but it produces a circumferential tension of equal magnitude, which is balanced by the compressive stress in the rock. The circumferential unit stress in a tunnel at great depth in rock is given by the formula

$$\sigma_\theta = D\,\gamma\left(1 + \frac{r_o^2}{r^2}\right) \text{(compression)},$$

and due to a heavy liquid which fills the tunnel

$$\sigma_\theta'' = -\,D_{,}\,\gamma_{,}\,\frac{r_o^2}{r^2} \text{ (tension)}$$

where σ_θ = compression in rock due to its own weight
σ_θ'' = tension in rock caused by fluid under tunnel
γ = unit weight of rock (assumed = 160 pounds per cubic foot)
$\gamma_{,}$ = unit weight of water (62.5 pounds per cubic foot)
D = depth or rock above tunnel
$D_{,}$ = head of water on tunnel (1220 feet)
r_o = radius of tunnel
r = a radial distance into the rock measured from the tunnel axis.

The resultant circumferential stress in the rock (or concrete lining) is therefore:

$$\bar{\sigma}_\theta = \sigma_\theta + \sigma_\theta'' = D\,\gamma\left(1 + \frac{r_o^2}{r^2}\right) - D_{,}\,\gamma_{,}\,\frac{r_o^2}{r^2}$$

$\bar{\sigma}_\theta$ max. where $r = r_o$

$$= 2\,D\,\gamma - D_{,}\,\gamma_{,}$$

Assuming a concrete lining capable of resisting 50 p.s.i. in tension, which equals 7200 pounds per square foot, we shall have

$$-7200 = 2\,D\,\gamma - D_{,}\,\gamma_{,}$$
$$= 2D \times 160 - 1220 \times 62.5$$
$$D = 216 \text{ feet.}$$

That is, the minimum amount of rock cover in any direction is 216 feet. In the case of the Spray tunnel this condition was encountered 350 feet from the downstream portal. From this point to the portal, the tunnel was lined with a steel pipe. The thickness of the pipe wall was increased inversely in proportion to the depth of cover, from 7/16 inch to 1 3/8 inches at the portal. The theoretical treatment is from Terzaghi "Theoretical Soil Mechanics".

The finished diameter was 8 feet in the concrete lined section. The diameter of the steel lined sections was reduced progressively from 7'6" at its upper end to 56" at the turbine valve. The tunnel, before lining, was about 11 feet high by 10 feet wide, and roughly horseshoe shaped.

The driving was carried in from the downstream portal only, and the drift advanced rapidly. Only three water bearing fractures were encountered. Progress in the raise, partly on account of the 45 degree slope, was slow, and difficulty was experienced in keeping on line. As a result, the overbreak was large, being 42 percent, as compared to 15 percent in the drift. Five hundred and fifty feet up the raise, several heavy flows of water were encountered, and the discharge from these soon reached such a volume as to make further driving impossible without first grouting. By carrying a small heading forward on the side of the face where the leakage was least, it was possible to pressure grout into the wall and intercept the fractures from the side. As a precaution against further heavy flows, a series of diamond drill holes were drilled 50 or 60 feet ahead of the face, and whenever water was encountered the hole was grouted. Then, before slashing the small heading to full width, a grout curtain was formed well outside the lines of the tunnel in the fractured zone, so that there would be no danger of again breaking into the water. The wet section extended about 150 feet, and took 40 days to penetrate. Beyond this, no further trouble from water was experienced.

Once the tunnel was "holed through", and prior to placing the concrete lining, more grouting was done in an attempt to further reduce the seepage to the point where concrete could be poured. The results were good, except for a length of 140 feet where the water came from fractures so tiny that they refused the grout. A total flow of about 200 gallons per minute came from these cracks, and it was therefore not possible to use the normal method of concreting in this section. A steel pipe 8 feet in diameter, made of 3/8-inch plate, and stiffened by outside ring girders, was inserted into the wet area in lengths of 20 feet. Due

to the water, work on the outside of the pipe was almost impossible, and so each section was equipped with jack screws around its circumference, which could be turned from the inside. By means of these, the erection crews were able to line up the pipe and secure it rigidly in position. The pipe sections were also equipped with coupling bands to ensure reasonably tight joints. Grout holes equipped with threaded plugs were provided to permit final grouting. The space between the pipe and the rock was then filled with concrete. A great deal of the mortar was washed out of the concrete by the water, but with the grout holes it was a simple matter, after the concrete had set, to pressure grout and tighten the porous concrete.

Work in the raise was difficult and slow, under the conditions of steep slope, small bore, and water, and a great deal of ingenuity was necessary both in the tunnelling and lining operations. The tunnel was headed July 27th, 1949, and concreting began in July 1950. Due to delays, the lining was only half completed in November 1950, when work was suspended. Resumed in April 1951, the lining was completed July 30th 1951.

The tunnel was unusual only in the length of raise, and normal methods were used in driving. However, in concreting the raise, a rather unusual and simple scheme was employed. The concrete was delivered to the forms by gravity down a 6 inch pipe laid the full 1,200 feet. At first, the concrete was discharged into a hopper 200 feet above the form, and then through a control gate into another pipe leading to the form. The purpose of the hopper was to reduce the velocity of the concrete, and was designed to correct any segregation which might have occurred in the concrete during the long trip down the pipe. It served its purpose most effectively, but also reduced the progress, being one more piece of heavy equipment to move, under adverse conditions, before each pour. For the sake of speed, therefore, the hopper was eliminated, at some sacrifice to the quality of the concrete, but with a corresponding increase in output.

The concrete in the drift was placed at first by means of a pneumatic placer, and later using a "pumpcrete" with pneumatic boost near the delivery. The steel lining was concreted by means of the pneumatic placer.

The steel lining had not been designed to resist unbalanced hydrostatic pressure acting on the exterior. This condition could occur when the penstock was emptied quickly, leaving the surrounding rock saturated with water under pressure. Such an occurrence is possible in rock such as that encountered here, where small fractures intercepting the tunnel could conceivably be connected to the unlined intake canal. It was, therefore, advisable to provide some means of relieving external pressure in the steel lined section. This was done by laying a perforated galvanized pipe, six inches in diameter, on each side of the penstock, against the rock. These pipes were wrapped in heavy paper to prevent the entry of mortar during concreting. At the tunnel outlet, these drain pipes were connected to a header which discharged into the tailrace of the plant. The drains were then buried in the concrete poured around the liner.

In order to ensure that all the space between the concrete and the rock, both in the steel lined and the concrete lined sections was filled, grout holes were drilled through the crown, reaching to the rock, In the steel lined section, there were tapped holes provided for the purpose. All these holes were pressure grouted. Some holes took a surprising volume of cement grout. One, in particular, took 70 cubic feet before the grout came out of the next hole which was 40 feet away. The grouting was repeated until all areas refused to take any more. Even after this was completed many small seepages existed through the concrete, in sections where leaks had been encountered during the driving. On unwatering the tunnel after it had been in service for 3 weeks, these seepages were found to have gained very little in volume.

Canmore Creek

Under normal operating conditions, the discharge from the Spray Plant is passed through Rundle Plant. The Rundle Pond provides sufficient volume to absorb fluctuations between the two plants. In the event of a shutdown at Rundle, means of by-passing the Spray discharge is provided by a siphon spillway consisting of 2 siphon tubes, each with a capacity of 350 c.f.s. The siphons discharge over a steep rock outfall into Canmore Creek, which flows in gravel and wash material and has a gradient of 260 feet in one and one-half miles to its junction with the Bow River. This gradient provided a stable bed for the flow of the tiny creek in its natural state, but with a discharge of 700 c.f.s., heavy erosion of the unconsolidated reaches was to be expected. No other practical method existed whereby the water could be conducted to the Bow River. Any other scheme would have necessitated structures more costly than would be the maintenance of the creek channel during the period of erosion. Spray Plant was put into operation two and one-half months before Rundle was ready, and so the siphons went into service immediately. The erosion was spectacular, and observation of the stream's performance provided a most interesting demonstration of the building of a river valley, on a very much compressed time scale. The immediate problem of disposing of the products of this erosion was most pressing, however, and it was necessary to station three 2-cubic-yard draglines and 6 bulldozers in the Bow, below the mouth of the creek, to remove the sand and gravel which accumulated at a maximum rate of 6,000 cubic yards per day and which on numerous occasions threatened to engulf houses and railway and roads. In all, about 200,000 cubic yards of material was heaped up on an island in the Bow before the Rundle Plant was put into production, and the siphons ceased to operate. However, by that time, the creek bed was almost stabilized and very little material was being carried down.

Conclusion

The Spray Project was noteworthy in the great variety of problems which arose both in its design and construction. Precedents for some of these problems were difficult to find. Probably many errors were made; certainly a great deal of experience was gained. For the successful completion of the project, much credit is due to the ability and resourcefulness of the contractors responsible for carrying out the work.

For the paragraphs describing the geological features, the writer is indebted to Doctor John A. Allan, HON.M.E.I.C., of Edmonton, who was consulted on nearly every phase of the project. Dean R. M. Hardy, M.E.I.C., of the University of Alberta was kind enough to furnish observations on the cause of the canal failure, and his comments have been incorporated.

Mr. D. W. Hays, M.E.I.C., was consulting engineer appointed by the Director of Water Resources of the Province of Alberta and, as such, took an active part in the planning and execution of the project. Other consultants were Dr. Thomas Hogg, M.E.I.C., Professor I. F. Morrison, M.E.I.C., Dean R. M. Hardy, M.E.I.C., and Prof. T. Blench, M.E.I.C. √

Donjek

About 250 miles south of the Arctic Circle and 100 miles from the Canada-Alaska border, Royal Canadian Engineers are nearing the final stage of the most northerly, and largest peacetime construction job ever undertaken by Canadian Army sappers. With all substructure concrete poured and steel ready for assembly, the new Donjek Bridge at Mile 1130 on the Alaska Highway will be ready for traffic across its 1,600-foot length on June 1st, 1952.

When complete, this will be the longest standard-type truss bridge on the 1,221.4 miles of Canadian Army Road. Only the famous Peace River suspension span of 2,130 feet, 49 miles northwest of Dawson Creek (Mile 0), is longer.

Planned in 1943 by the United States Public Roads Administration, which stock-piled necessary steel for the job at Whitehorse the following year, actual construction did not start until 1949. When a rush order to "get the highway through and to h . . . l with fancy trimmings" came out at the time of the Kiska landings, the permanent project was shelved in favour of a causeway with seven timber-trestle spans.

Flash flooding of the Donjek has washed out some of the timber crossing every year. With the highway rerouted to the new bridge about a mile from the old trestle, costly repairs and halting of traffic during the flood season will be eliminated. Army authorities of the Northwest Highway System (the official name for main and access roads) at Whitehorse, feel that flood trouble on the Donjek will then be over.

Planning, when work started in the spring of 1949, was on a long term basis. A small crew of 20 to 40 sappers and civilians worked for two years preparing the south access road, surveying, gathering equipment, stock-piling gravel and cement and keeping up with accommodation and administrative problems. These few worked for two summers and winters, but all they had to show above ground for their "training program" was the south abutment and Pier No. 1, with six piers and another abutment to go.

Early in 1951, Major R. M. Black, of Sussex, N.B., was placed in command of 1 Road Maintenance Company, R.C.E., the highway detachment responsible for all new work on the road, and told, "pull all stops and get the thing finished". Major Black and his company of about 125 moved from Whitehorse, 210 miles north, to the bridge site. In April, 1951, the new era of "getting the thing finished" started.

Throughout last summer and fall pier-piling and coffer sheeting was driving into perma-frost and river bed, cribbing was set in place, pier forms were erected and over 2,300 yards of concrete were poured. Steel was hauled from Whitehorse and, as fast as cured concrete would take it, erected across the 200-foot gaps.

Despite flash floods in July which scoured the river to a depth of 28 feet from a normal of six feet in a matter of four hours, progress is only slightly behind the proposed schedule. That flood gave a real demonstration of nature at its worst. At 2 o'clock one morning everything appeared normally secure. By 6 a.m. the river was a torrent, which washed out the work bridge, coffer and Pier No. 4, and underscoured all of the heavy equipment which had been left sitting on the dry river bed.

When the flood abated, a 104-ton Lima crane and a 67-ton Lorraine crawler crane were half buried in silt. A 5-ton steam boiler was found only with the help of a mine detector. Many pieces of smaller equipment, such as power saws and riveting hammers, are still somewhere in the river bed.

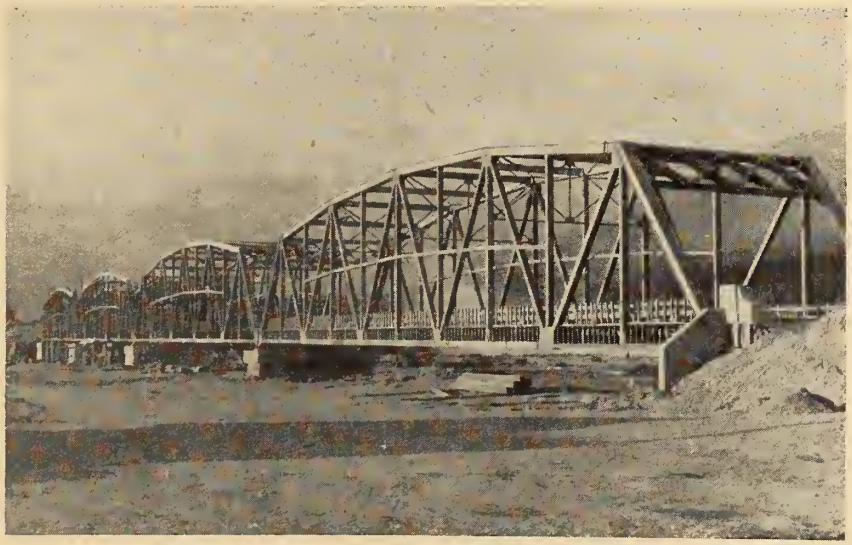
Just short of two months of construction time was lost because of the floods, but by the end of November, when crews were cut to skeleton numbers, the sappers had the Donjek licked. In eight months they placed all the concrete and strung steel across four of the eight spans. Pier No. 7, the last, was poured in temperatures which ranged from 20 to 40 degrees below zero.

In rushing the bridge along the sappers piled up a considerable record. They used about 17,000 bags of cement to pour almost 2,500 yards of concrete reinforced with 60 tons of steel. In addition, they erected 1,030 tons of structural steel and tied it together with more than 14 tons of rivets.

The biggest job left, other than stringing the four remaining spans, is levelling and grading the two-and-one-quarter mile north approach road. Fifty-five thousand cubic yards of perma-frost has to be moved to provide a bed for the road. In the work already started it was found that a world of thousands of years ago is within 15 feet of the surface. The sappers are blasting through two feet of volcanic ash and down further to clear solid ice deposited there during the last glacial age.

Drilling of blast holes is comparatively simple. Two-inch pipes jetting steam from a 20-hp. boiler melt their way ten feet into the permanently frozen ground in a matter of minutes. As soon as the water is blown out of the holes with compressed air, they are ready for their charges.

Completion of steelwork erection, and finish grading of approach roads as well as pouring of the concrete deck of the bridge remain to be carried out during April and May, to meet the scheduled official opening date at the end of May, 1952.



Looking north along the first four of eight spans. Span No. 1, in the foreground, shows deck framing in place ready for pouring of concrete roadbed.
(*National Defence photo*)

The Organization and Functions of an Instrument Department

by

A. H. Wilson Busby, M.E.I.C. and W. G. Small

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Supervisor of Instrument Section Research and Development Division

Consolidated Mining and Smelting Company Limited, Trail, B.C.

A paper to be presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, B.C., May 7, 8, 9, 1952.

The Consolidated Mining and Smelting Company has long recognized the importance of centralizing all phases of the care and use of instruments and control equipment for process control, in a central instrument department, as part of their Research and Development Division.

Representing the best modern practice, the general principles and methods governing the operation of this department are of wide interest as a pattern which other industries may follow to their advantage. Dealing with each phase in turn, research, installation, maintenance, stores, and application engineering, the authors visualize the plant of the future operating itself and doing its own bookkeeping.

In practically all processes involving variables, there is a set of optimum conditions, which if maintained, will produce the highest quality finished product at the lowest possible cost. This is true whether it applies to the making of bread in your own kitchen or to a highly complicated chemical process.

In order to maintain these optimum conditions it is necessary for the operators of the process to know at any given instant the magnitude of the variables involved, and thus be enabled to subject them to the necessary control. The only efficient way of determining the magnitude of the variables is to measure them by means of instruments. The subsequent control can then be either manual or automatic.

Manual control involves the use of human muscle power, which is by far the most expensive form of power available, and which is subject to all the fallibilities of human nature. Low efficiency, and a poor or non-uniform product may result. Modern automatic control instruments are generally dependable and accurate, and will operate day in and day out without fatigue. Some complex processes which cannot be controlled at all by hand can be easily controlled automatically, and most processes can be controlled more accurately and efficiently by automatic means. Measurement and control therefore go hand in hand, and can be referred to by the general term "Process Control".

Although, of course, instruments and process control equipment of one kind or another have been used for many years, process control as we know it today is a comparatively recent development, dating roughly from the depression of the early thirties. This depression taught us, among other things, that if we want to stay in business we have to operate efficiently. Then came World War II, and with it the development of new and complex processes, and the necessity for greatly increased industrial production with limited manpower. Currently, we in Canada and the United States, are engaged in the most extensive, and expensive, re-armament program the world has ever seen while at the same time attempting, with some success, to maintain a high standard of living. One result of all these factors has been a tremendous increase in the use of process control instruments. There has been a corresponding increase in the complexity and diversity, and number of types and makes of instruments commercially available, and a corresponding improvement in the instruments themselves.

The increasing complexity and diversity of modern process control equipment make it essential that the responsibility for the specification, installation and maintenance of this equipment be centralized, with specially trained personnel. This is true whether the instrument work requires one man or fifty men. It is fatal to leave the purchase of instruments to anyone who is not technically qualified, and similarly, their installation and maintenance to tradesmen who are not specialists in this work.

In the modernization of an old plant, or the building of a new one, a new problem therefore often arises, namely, that of organizing an instrument department. In which case, a description of the Instrument Department of The Consolidated Mining and Smelting Company of Canada may be of some interest.

Although Cominco has organized its instrument department to fill the needs of its own operations, close touch has been kept with developments in other industries, such as oil refining and synthetic rubber manufacture, and in many cases use has been made of the experience others have gained. It is felt therefore that the Cominco Instrument Department can be considered as representative of the best modern practice. The general principles and methods governing its operation can be applied to other industries re-

gardless of the type of process concerned or the size of instrument department required.

Organization

The Instrument Department of The Consolidated Mining and Smelting Company has, since its inception, been part of the Research and Development Division, and this arrangement has worked out very well. The Instrument Department's supervisor reports directly to the superintendent of engineering research and development, who is necessarily in close contact with both the Research and the Engineering Divisions. In this way, the Instrument Department is kept informed regarding plant operating problems, proposed changes or extensions to existing plants or proposed new plants, and works with the research engineers on these problems. When a project reaches the engineering design stage the Instrument Department works in close liaison with the Engineering Design Office.

It cannot be too strongly emphasized that today process control is an essential part of the design and engineering of any plant, and that instruments must be considered from the time the first rough flow sheet is drawn. The man who carries out the preliminary laboratory scale work must keep instruments and automatic control in mind, and should the process go to the pilot plant scale, then this plant should be fully equipped with process control instruments. Often, in order to achieve the close control desired it is necessary to modify the process, or change the design of the plant. Only in this way can the full value of modern process control be realized in the final plant.

Fig. 1. Instrument application engineering office.

Although a major part of the Instrument Department's work consists of maintenance of installed instruments it is not considered desirable to include the Instrument Department in the mechanical service division of a company. There is a fundamental difference between instrument maintenance and other maintenance work. An automatic controller, or any instrument used for process control, can be considered to be an operator. The personnel responsible for the selection, installation and maintenance of that instrument are therefore part of operation. In general, therefore, the Instrument Department should be related as closely as possible with the operating, research and development departments, and also work in close co-operation with the Engineering Design Department.

The Cominco Instrument Department is divided into four main sections, viz.:

- Application Engineering
- Installation and Maintenance
- Instrument Research and Development
- Records and Stores

It has been found desirable to separate the functions of the Instrument Department in this way for several reasons. For instance, a man responsible for maintenance has very little time as a rule to consider special problems, and a man working on a special problem should be free to give his entire time and thought to that problem, without continual interruptions. At the same time there must be complete co-operation between these sub-sections. Regular meetings of the Engineering and supervisory personnel of the Instrument Department are held, where all important work in progress is reviewed.

The functions of the sections of the instrument department will now be discussed under their appropriate headings.

Application Engineering

When the need for new instruments arises, it is the responsibility of this section to prepare complete specifications of the instrumentation required, together with a detailed estimate of the total installed cost. As can be appreciated this involves a considerable amount of work. The instrument engineer must first make

BA 45 — NITRATE PLANT — NH_3 GAS

1 MONTH	3 MONTH	6 MONTH	12 MONTH
Blow down	Clean & Calibrate	Change Mercury	Gen. Overhaul Insp. Orifice
June 18 - 50			
July 19	July 19 - 50	July 19 - 50	
Aug. 18			
Sept. 17			
Oct. 18	Oct. 18 - 50		
Nov. 17			
Dec. 18			
Jan. 18 - 51	Jan. 18 - 51	Jan. 18 - 51	Jan. 18 - 51
Feb. 16			
Mar. 16			
Apr. 18	Apr. 17 - 51		
May 16			

Fig. 2. Planned maintenance schedule form.

S-86 The Consolidated Mining and Smelting Co. of Canada Ltd.
Research Division -- Instrument Section.
Maintenance Schedule.

Name INSTRUMENT MAINTENANCE MAN Date JAN 7 to JAN 13

Plant	Flush or Blow Down	Clean & Check Calibration	Clean Slide Wire	Check Temperature	Check & Clean Cell	Check Alarm	General Overhaul	Date Completed
SMELTER		BA 62						
"		FA 91						
"	BA 76							
"	C4							
"			LN 69	LN 69				
"		BR 82						
"		BR 81						
"		BN 99						
"		BN 98						
"		BR 79						
"						P-1		

Fig. 3. Planned maintenance work instruction form.

himself fully acquainted with the process involved. Temperatures, flow rates, pipe line sizes, tank capacities, electrical constants, etc., must be known. Process lags and other factors affecting the operation of automatic controllers must be determined. The corrosive and other chemical and physical properties of the materials to be handled must be known as well as the general plant conditions and operating procedures. As a rule a special flow sheet of the process must be drawn, showing complete instrumentation.

In the case of a new process or plant, frequent discussions are necessary with the development engineer responsible for the process, the operating representative, and the engineering design office. This is extremely important, because if the best control conditions are to be obtained, the new plant must be so designed that it is capable of being controlled. In the case of instrumentation of an existing plant, discussions must be held with the plant superintendent and the plant development engineer. In many cases the instrument manufacturers must be consulted and their opinions obtained. Special problems must be referred to the development section of the instrument department for research work if necessary. Quotations must be obtained from the manufacturers, and sub-estimates obtained from the other service departments of the company who may be involved, such as the electricians and plumbers, for their part of the installations. Layout drawings have to be made of the instrument rooms, panel boards, etc. When the detailed specifications and estimate have been completed and approved, the orders are placed with the Purchasing Department, detailed drawings made, and the job followed through until the instruments are installed and operating satisfactorily. In short the Application Engineering Section is responsible for all the details necessary for the correct instrumentation of a process.

Fig. 4. Instrument shop for precision work.

Maintenance

With the important role that process control equipment now plays in industry, it is essential, in order to prevent costly shut-down of the process, that the instruments be kept at all times in first-class operating condition. To accomplish this, it is necessary that the Instrument Department install a system of planned preventive maintenance, whereby all process control equipment is serviced and checked at regular intervals. In order to carry this out effectively we have found it desirable to split the maintenance section into two parts consisting of the plant instrument servicemen and the shop specialists.

The plant men have been trained to carry out routine maintenance on all types of instruments, both electrical and mechanical. The shopmen are generally specialists in one or two related fields.

Each plant instrument serviceman is assigned to a specific plant or area and made responsible for the routine maintenance of all process control equipment within that area. These men are rotated from time to time, to keep them from getting in a rut, and to broaden their experience and make them more generally useful. Jobs requiring special skill or knowledge beyond the serviceman's scope are assigned to specialists.

In order that the equipment will receive regular servicing and checking, we have established a "tickler" card system. A card is made out for each instrument (Figure 2), and on it is noted the required maintenance schedule. These cards are filed in a cabinet having separator cards for each week in the year, and the maintenance cards are filed under that week in which the next servicing is due. These cards move forward in the files as the work is carried out,

the current week always being at the front of the file. On Monday mornings, the foreman takes out the current week's cards, and notes on a standard form (Figure 3) which he gives to the servicemen, those instruments which are due for servicing. On completion of the work these forms are returned to the foreman. The cards are then checked off, redated and filed again under the next due date. A standard Kardex system may also be used.

This regular servicing is of course in addition to the routine inspections, which most instruments receive daily from the plant servicemen.

The system has worked very well and, as a result, loss of production due to breakdowns of process control equipment has become extremely rare. Another result of the system is that plant servicemen take more interest in their work when they are given the sole responsibility for the correct functioning of the equipment in their area, and, what is most important, they become thoroughly familiar with plant operations.

We have not found it necessary so far to have instrument maintenance men on all three shifts. The men work day shift only. There is always a supervisor on call, but with a planned maintenance schedule, "call-outs" are relatively few.

The number of maintenance men required for a given number of instruments will vary widely, depending on the physical layout of the plant, plant conditions, and whether the instruments are scattered or centralized in control rooms. A figure of from 100 to 120 instruments per man can be used as a rough guide in estimating the size of maintenance crew required.

An instrument department should have its own transportation equipment. We have a ½-ton truck, and also use bicycles where conditions permit.

Shops

Instrument repair shops should be well lighted and air conditioned. (Figure 4 and Figure .5) The work benches should be so designed that they can easily be kept clean, and the chairs made of a suitable height so that the men can work without undue fatigue. Each shopman should be allocated a section of the bench to himself, and be provided with easily accessible drawers, which can be locked, in which to keep his own small tools. Special tools should, of course, be provided by the company.

The bench lighting should be of the fluorescent type and arranged to give an intensity of at least 50-foot candles at bench height.

The equipment of an instrument repair shop will, of course, depend upon the size and diversity of the operation which the instrument department serves, but should include the necessary equipment for calibrating the majority of the instruments coming under the supervision of the Instrument Department. Mechanical equipment, such as drill presses, lathes, etc., necessary for the proper repair of instruments should be included.

With the great diversity of Cominco operations, and the physical location of the plant, away from large centres, it has been necessary to equip our instrument department fairly completely for the repair and calibration of a large variety of instruments. Besides the industrial instruments such as flow meters, pyrometers, gas analysers, pressure gauges, regulators, etc., we repair and service such items as mass spectrometers, optical instruments including spectroscopes, microscopes, transits, etc., meters for the electrical department, film projectors, sound systems, watches and clocks, and many other pieces of equipment where fine workmanship and specialized knowledge is required. It is also interesting to note that we repair and fill all thermometer systems, with the exception of those that are mercury filled, and design and make all our own orifice plates, of which there are now over 700 in use. We also design and make special apparatus for research purposes when necessary. In addition to the necessary mechanical equipment such as drill presses, lathes, etc., our equipment includes standard gas meters and provers, deadweight pressure gauge testers, and laboratory standard gauges, all kinds of electrical meters including a number of laboratory standards, bridges, potentiometers, test sets, vacuum tube voltmeter, oscilloscopes, etc.

Our shop crew consists of a precision mechanic, watchmaker, glassblower, electronics specialist and three general repairmen, who repair and calibrate gas meters, oil meters, pressure gauges and regulators, make up thermocouples and do the hundred and one miscellaneous jobs expected of an instrument shop.

It is interesting to note that with a system of planned maintenance it is rarely necessary to bring any of the control equipment into the shop for repair, except very infrequently for major overhauls.

Installation of Instruments

Installation work necessarily involves tradesmen other than instrument men. The instrument man will mount the instruments on the panel and see that they are calibrated and in good operating condition. The electrical wiring up to the control panel is usually done by the electricians, and the piping by the pipe fitters. The instrument man will then connect up the instruments and put them into operation. It should be understood, however, by the other service departments, that the work assigned to them must be carried out in accordance with the requirements of the Instrument Department.

Fig. 5. Electrical instrument repair shop.

Fig. 6. Instrument development laboratory.

Except for major installations it is usually not necessary to have a special crew for installation work. It is desirable, however, that the men who will be doing the maintenance work on the instruments should have some part in their installation.

Research and Development

It should be pointed out that this phase of an instrument department's activities can be a very costly one and it is definitely uneconomical to attempt to design and make instruments when suitable ones for the job can be purchased.

Instrument department personnel, by the very nature of their work, have to have plenty of imagination, and are always coming along with new ideas, which they want to try out. This attitude is very desirable and certainly should not be discouraged. However, before time and money are spent in experimental work, it is well to be sure that there is not some equipment on the market that will do the job, or can be readily modified for the purpose required.

In the Cominco Instrument Department, we try to adhere to this principle as rigidly as possible. However, due to the diversity of our operations, and the unusual conditions that exist in some of our plants, we have found it necessary, in a surprising number of cases to design and make special instruments, or to modify commercial instruments to suit our special needs.

Among some of the special instruments developed and made in our own shops, might be mentioned an SO_2 recorder for measuring low concentrations of SO_2 in air, an a-c operated null-balance type pH meter, an ammonia loss recorder, and a photo-electric turbidimeter for analytical control in one of our plants.

At present we have three men, two of whom are graduate engineers, engaged on instrument development work.

Records and Stores

Whether an instrument department is large or small, it is necessary for its efficient operation that very complete records be kept of the equipment in its care.

Where a system of preventive maintenance is in effect the importance of this phase of an instrument department's operation cannot be too strongly stressed. It is often necessary for an instrument engineer or serviceman to know what work has been done on an instrument not only last week, or last month, but possibly years ago. He also has to have all the pertinent data relating to the equipment at the time of its purchase and installation. Proper records also show when the cost of maintaining an instrument is becoming excessive, when some change is necessary in the method of control, or when the instrument has reached the end of its useful life and should be replaced by new and more up-to-date equipment.

In the Cominco Instrument Department, all items of process control equipment, when received are assigned an Instrument Department number. These numbers have prefixes indicating the make of the equipment, i.e., Ba-1, Ba-2, etc., would indicate that they are Bailey instruments. We prefer this method of numbering because the number remains the same no matter for what service the instrument is used. For instance, if say a Brown pyrometer recorder is changed to a recording pH meter, the number does not change. These numbers form the

Form 1322 1M-9-50 Q.P.

The Consolidated Mining and Smelting Company of Canada, Limited

RESEARCH DIVISION - INSTRUMENT SECTION

INSTRUMENT RECORD

Make: LEEDS & NORTHRUP — Description: POTENTIOMETER RECORDER — No.: LN-69
Type: MODEL S — Serial No.: 309882 — Differ.: -
Bulb Data: - — Tube Data: — Pens: 3 POINT
Integrator Factor: - — Thermocouple Mat'l: CHROMEL-ALUMEL — Res. of Inst.:
Date of Purchase: JULY 24, 1941 — P.D. Order No.: 60832 — Price:
Work Order No.: 981 — Owner: SMELTER — Code: T-5102

Date	Location	Service	Design - Conditions	Range
SEP.15/41	FURNACE FEED FLOOR	FURNACE TEMP.		0-2400°F
JAN. 8/42	ZN.PLANT TANK ROOM	pH RECORDER		2-12 pH

	Orifice No.	D	d	K_1	K_2	Man liquid	Float No	Scale	Chart No.
								0-2400	365
								2-12	4

	Maintenance Details	Man Hours	Maintenance Cost $ Material	Labour	Total
1941					
Sept 12	Rec'd, checked	4			
" 15	Installed at smelter	8			
" 16	ch. cl. slidewire	1			
Oct 16	ch. " "	1			
Dec 15	Cl. lubricate, calibrate	2			
1942					
Jan. 5	To shop	2			
" 6	Change to pH recorder	8			
	Galvanometer 1300 ohms		11.60		
	pH slidewire assembly		28.80		
	Scale		5.00		
Jan. 8	Installed at Zinc Plant	6			

Fig. 7. Instrument maintenance record form.

4177

The Consolidated Mining and Smelting Company of Canada, Ltd.
Research and Development Division
Instrument Section
Daily Maintenance Record

Clock No. V-105

Name INSTRUMENT MAINTENANCE MAN Date JAN. 7 1951

Code	Inst. No.	Hours	Work Done
F32349	CM 339	1	SERVICED
.912.1	CM 711	1	CHECKED CALIBRATION
	LN 89		
	LN 100		
F32154	LN 93	6	CLEANED SLIDEWIRE, OILED,
	LN 80		ROUTINE CHECKING
	LN 113		
		8	

Fig. 8. Daily Maintenance Record.

basis for all our process control equipment records.

Number tags are attached to all items of equipment, in a location where they can readily be seen, and we encourage the operators to use these numbers when reporting trouble.

Separate file folders are used for all the data on each piece of equipment or groups of similar equipment, and are filed according to the Instrument Department number. These files contain such miscellaneous information as calculations, specifications, correspondence, installation and operation instructions, calibration sheets, correction factor charts, etc.

For maintenance records, a loose leaf system is used (Figure 7). The record sheets contain all the pertinent information relating to the items of equipment, such as make, type, serial number, initial cost, design data, date of installation, etc. The filing is again according to Instrument Department number. The records are kept up-to-date by the following method. Each instrument serviceman indicates briefly on a standard form (Figure 8), which he turns in at the end of each day, the work done on any instrument during the day. These forms are checked and edited by the foreman and turned over to the records clerk, who enters all pertinent data on the maintenance record sheet. When the sheets become filled they are taken out of the loose leaf books, a new sheet substituted, and the old one placed in its appropriate folder in the files.

With this maintenance record system, we can tell at any time what work has been done on an instrument, when it was done and how much it cost.

To facilitate the flow of work through the Instrument shops, and prevent the possibility of misunderstanding and confusion, a written work order is used in connection with all new installations and special jobs, other than routine maintenance and repair work (Figure 9). The work order is issued by the Instrument Department supervisor to the foreman concerned. It contains as far as possible complete details of the job, such as orifice sizes, location, correction factors, design conditions, etc. If necessary, any drawings, calibration graphs, etc., are attached to the work order. We try as far as possible to have a job completely engineered before turning it over to the foreman. On completion of the job, the foreman returns the work order to the supervisor.

In order to keep track of the cost of instrument servicing in the various plants, all maintenance work is charged to an open work order covering that particular plant, and the monthly total charges to these work orders are plotted on a suitable graph paper. By this means any unusual conditions regarding costs are immediately apparent, and suitable action is taken where necessary.

All calibrations are recorded on a standard calibration sheet (Figure 10). They are checked by the supervisor, and the original placed in the equipment files. A copy is placed in the shop files and where necessary a copy is also sent to the operating department concerned.

Stores

Instrument Department stores are valuable and should be kept in a clean, warm and dry location. They should be in charge of one man, who will be responsible for issuing the

FORM 1482-OCT.-'51-MINER

Work Order No. SAMPLE

The Consolidated Mining and Smelting Company of Canada Limited

INSTRUMENT SECTION

SHOP WORK ORDER

To SHOP FOREMAN TADANAC, B. C. DEC. 9 19 51

Please execute the following order. Return this form on completion to ENG OFFICE

Install orifice meter on condensate line at Aluminum Sulphate Plant

Recording flow meter No. F111

Flow range 0 - 25 GPM of water at 65°F

Orifice plate No. 5500

Completion required by Dec. 31 DATE and should be effected during operation X during shut-down

Estimated cost $250.00

For futher information see PLANT SUPT. Charge to Code No. F41013

Approved SUPERVISOR Signed INSTRUMENT ENG'R.

Fig. 9. Instrument shop work order form.

The Consolidated Mining and Smelting Company of Canada, Limited

INSTRUMENT SECTION

CERTIFICATE OF CALIBRATION

Description A.C. - D.C. VOLTMETER Cominco No.

Make EVERSHED & VIGNOLES Type Serial No. 216462

Location W.K.P. & L. COMPANY Service 0 to 300 V.

Orifice or Float No. Range or Differ OCTOBER 14, 1948

Chart No. Date of Calibration

STANDARD READINGS		METER READINGS		ERROR	
ACTUAL	CORRECTED	ACTUAL	CORRECTED	HIGH	LOW
120		120			
139		140		1	
160		160			
180		180			
200		200			
220		220			
240		240			
260.4		260			0.4
281		280			1
299.6		300		0.4	

Accuracy of Meter 0.3 % of Full Scale Reading

Remarks:

Calibrated by G. Shaw

Fig. 10. Calibration certificate form.

stores and keeping the inventory up-to-date.

We find that with our preventive maintenance scheme, it is not necessary to keep a very large stock of spare instruments. However, it is vitally necessary that sufficient spare parts to service the instruments be kept on hand. This is where the economy of limiting the number of different makes of instruments becomes apparent.

The Cominco Instrument Stores, although kept in the Department for convenience, are part of general warehouse stock, and subject to all the conditions governing that stock. Material can only be taken out by means of a requisition. However, in order to assist us in keeping our own records, the persons requiring material fill out a special Instrument Department form marking thereon the instrument number for which the material is required. Once or twice a week the storeroom clerk takes these forms and from them writes out the regular warehouse requisitions, which are made out in triplicate. One copy is then returned to us by the warehouse with the prices marked on it. The instrument numbers are also marked on the requisition so that the cost of material for each instrument can be entered on the loose leaf maintenance sheets.

Personnel

Due to the tremendous strides that process control has taken during the past few years, the demand for instrument engineers and service men far exceeds the supply. It is regrettable that our universities have lagged behind industry in this regard. With the exception of perhaps two or three universities in the United States there appears to be none who offers courses in process control engineering. The same thing applies to trades schools, and it has been left to the instrument manufacturers to institute short courses for the convenience of their customers. This has its drawbacks for obvious reasons.

In the Cominco Instrument Department we have had to train our own men, and several years ago were recognized by the Provincial Government as a suitable establishment for the training of apprentices as instrument mechanics (one of the first, if not the first, in Canada).

The supervisor of an instrument department should be a graduate engineer, mechanically inclined, with a good knowledge of electronics, physics and chemistry. He should preferably have had several years experience in plant operation and have a definite interest in process control.

The application engineering, and research and development sections of the instrument department should also include graduate engineers, with the necessary qualifications and aptitude for the work involved. An intimate knowledge of the plant processes and some practical experience in plant operation are essential.

First class instrument mechanics are virtually unobtainable on the open labour market today. It is usually necessary therefore to train the men on the job. Given a man with the necessary education and aptitude, and preferably with some background of plant operating experience it will take at least four years of intensive on-the-job training to make a first class instrument mechanic out of him. Future needs must therefore be anticipated, and a more liberal policy adopted regarding labour requirements for instrument work than may be necessary in other trades where men may be obtained on the open market as job requirements dictate.

At Cominco, only apprentices are taken on for training. Experienced instrument mechanics or shop specialists may be hired from time to time if required, and if available.

Our requirements for a first class instrument maintenance mechanic may be of interest. He must have a secondary school education equivalent to Junior Matriculation, and a definite aptitude for working on small, precision type mechanical and electrical apparatus. The determination of required aptitudes is assisted by a series of selected personnel evaluation tests administered by the Company industrial psychologist. His best subjects at school should be mathematics, physics and chem-

istry. He must be above average in intelligence, resourcefulness and initiative, and have the ability to get along with people. He may be required to shoot trouble on, and make on-the-job repairs to, any one of some 4,000 instruments of almost every conceivable type and make. He must acquire a detailed knowledge of the process and operating procedure of the plant in which he is working. He must be able to cooperate with plant operators, shift bosses, plumbers, electricians, boilermakers, and the man who once read an article on instruments. He must be conscientious and reliable, as much of his work is done without direct supervision.

The Cominco Instrument Department is responsible for the maintenance of approximately 4,000 instruments having an installed value of about three-quarters of a million dollars. The maintenance staff now totals 36 men, including foremen, plant maintenance men, shop men, apprentices and clerks. There are in addition six men, four of whom are graduate engineers, including the supervisor, engaged in application engineering and development work.

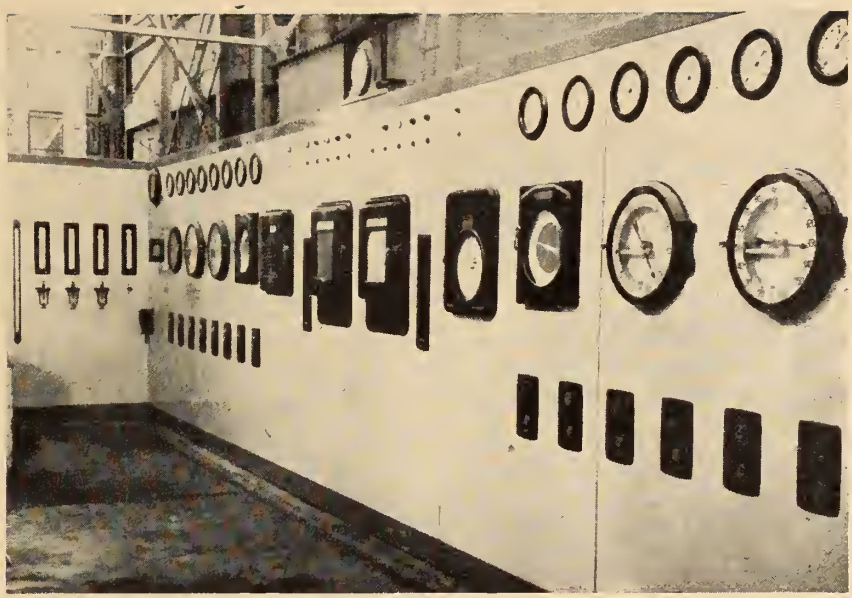

Fig. 11. Conventional instrument panel.

Conclusion

Tremendous progress has been made during the past two decades in the application of automatic process control equipment. Instruments are no longer regarded as gadgets, to be added to a plant if required, after it is built, but are now recognized as an essential part of the plant operation, and the plant often is designed around the process control equipment. Instruments are centralized in attractive, well lighted, air conditioned control rooms, and the whole operation is under the supervision of one chief operator. He has complete control of the operation from the control room, and can keep in contact with his assistant operators, helpers, or maintenance men by means of a P.A. or intercommunication system. Instrument panels may be conventional (Figure 11) or console type (Figure 12) or graphic panel type, as required.

It would be a mistake however to assume that we have reached the ultimate in process control. We can be sure that the plant of the future will be different from what it is today. Equipment is now available that will automatically "scan" up to 3,000 process variables, and report to the operator, by means of flashing lights, horn and a chart record, if any one of these variables deviates from the desired value. Instruments for continuous analysis are becoming available, so that instead of setting all the process variables at pre-determined values to obtain a given product, the product itself, and the raw materials, might be continuously analysed, and the variables automatically controlled to give a product having the desired chemical and physical properties. With the development of electronic computing machines there would seem to be no reason why a plant could not only operate itself but also do its own bookkeeping, and issue a financial statement at the end of the year. This may be a slight exaggeration, but the point is to keep an open mind, and to use to the fullest extent all the process control equipment and techniques that may be developed. Only in this way can the highest possible productivity and a high standard of living for everyone be assured.

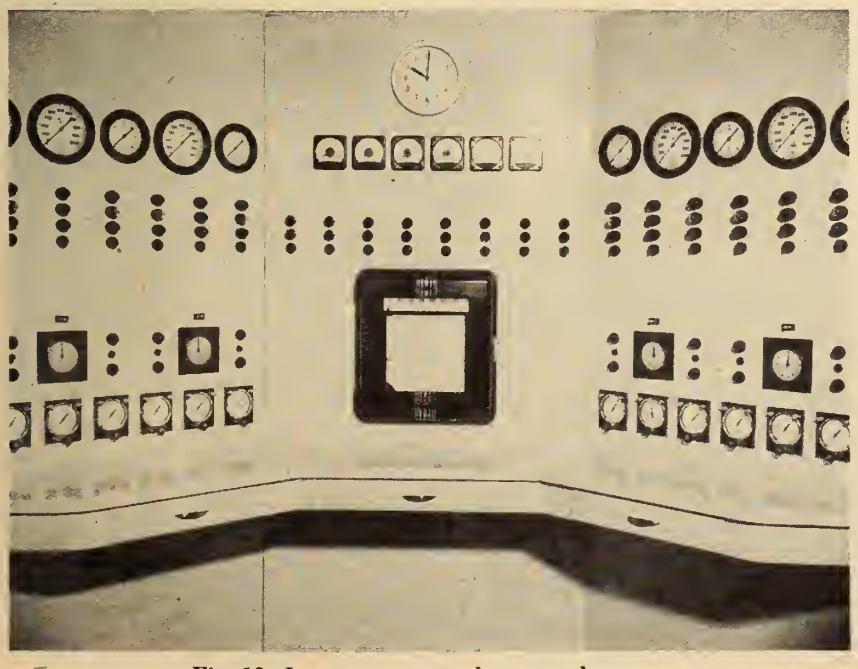

Fig. 12. Instrument panel — console type.

Acknowledgment

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Large Steam Electric Stations of the Ontario Hydro

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INTRODUCTION

Commencing with a number of emergency steam-electric stations, having units of 5 to 10 megawatts, in the latter part of 1949, the expansion program of the Ontario Hydro will, by the end of 1953, have 700,000 kw. of "steam" available for peak loading and emergency reserve, at a total cost of about 125 million dollars.

Two large stations, the Richard L. Hearn Generating Station (Toronto), and the J. Clark Keith Generating Station (Windsor), are now planned for four units each. The former station will have 100 megawatt units and the latter 60 megawatt units. Both stations will have a unit equipment arrangement and operating characteristics will be—steam, 850 p.s.i.g., 900 deg. F, 28½ in. mercury—electrical, 3 phase, 25/60 cycle and 60 cycle, 13.8 kv. generation to 110 kv. transformation. Pulverized coal firing with oil firing in reserve and full automatic control will be in use at both stations.

It is expected that "steam" generation carrying the system peak loading, will, along with "hydraulic" generation for base loading, provide an economical arrangement for a rapidly expanding system.

This paper will discuss the mechanical and electrical features of the Richard L. Hearn Generating Station (Toronto), and the J. Clark Keith Generating Station (Windsor). These stations were named in honour of the Commission's General Manager and Chief Engineer and the Manager of the Windsor Hydro-Electric System, respectively, for their meritorious services to Hydro.

Fig. 1. J. Clark Keith Generating Station. View looking across Detroit River towards the American shore.

This paper describes in detail the electrical and mechanical features of the two steam generating stations being built by the Ontario Hydro-Electric Power Commission in Toronto and Windsor. The completion of these in 1953 will bring the total of the Commission's steam power available for peak loading and emergency reserve to 700,000 kw.

Adaptable for burning either pulverized coal or fuel oil, the Richard L. Hearn Plant at Toronto will have an ultimate capacity of 100 megawatts, while the J. Clark Keith Plant at Windsor will have an ultimate capacity of 60 megawatts. To keep annual system power costs down to a minimum, these steam plants will operate on daily peaks of the high days of the weeks, in months when system loading exceeds hydraulic capacity available.

SITE AND BUILDINGS

Both stations are located on property bordering the Great Lakes water system, so that ample supplies of lake water are available for condensing purposes and coal can be unloaded directly onto the property from lake carriers.

The site for the Richard L. Hearn Generating Station (Toronto), is located at the east end of Toronto Harbour on a strip of land having a ship channel on the north and Lake Ontario on the south. Coal is received by boat in summer onto a storage area bordering the ship channel and water for condensing and station use is taken from the channel, passed through the equipment in the station and discharged into another channel having an outlet into the lake.

Power from the turbine-generators at 13.8 kv. stepped up to 110 kv. leaves on the north by 110 kv. transmission lines, hung from high towers for crossing the ship channel. The total site area is 59 acres.

The buildings comprise the main equipment building with an annex at the west end for the administration of the station, two screen buildings at the edge of the ship channel and a service building for the mobile coal handling equipment. The main building is constructed on the unit plan. Each building unit houses one steam generator with auxiliaries and one turbine-generator with its auxiliaries. Unit No. 1 is on the west and the other units progress to the east.

A control room for six units is located at the north of the turbine room. Concrete piles support the main building, a steel structure encased with brick-red outside, buff inside, and covered with a concrete roof of light-weight insulating slabs.

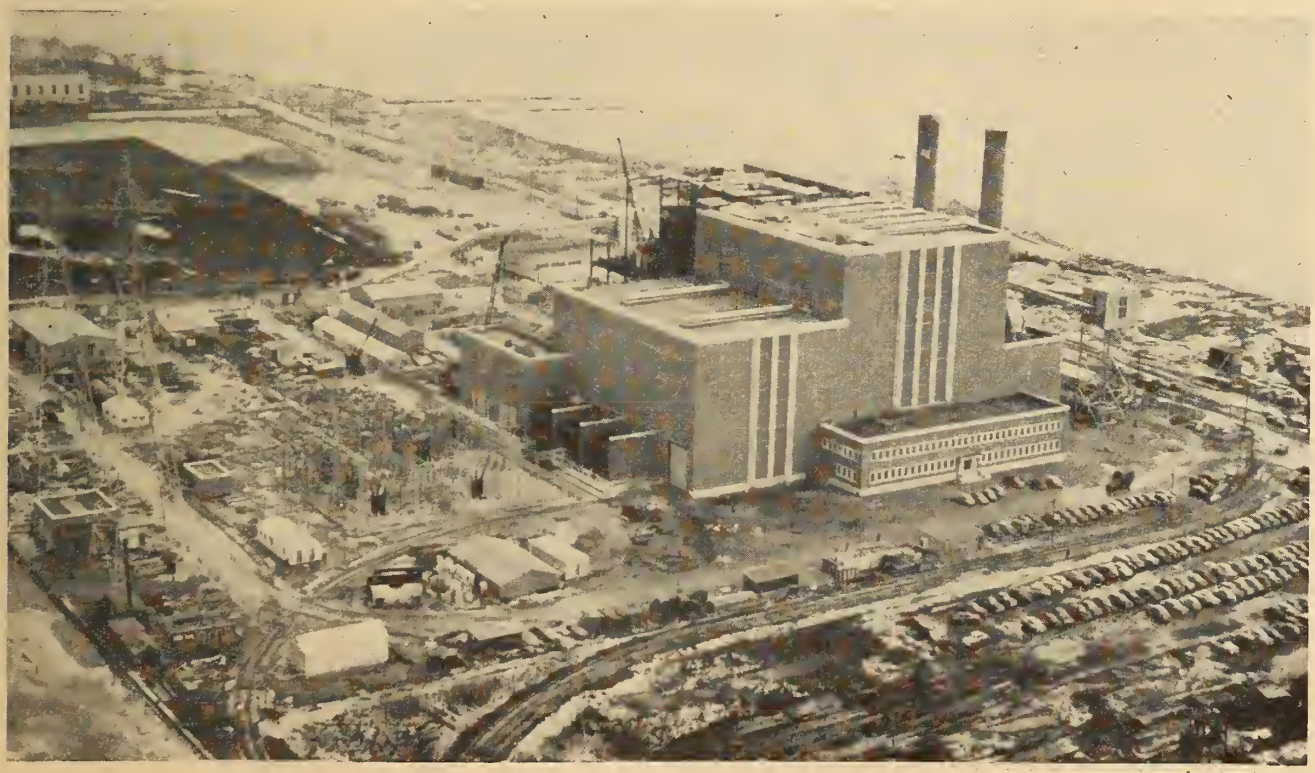
The annex provides offices and rooms for the station personnel, laboratory, machine shop, electrical shop and storage.

The piles of concrete poured in place, 20 in. diameter and expanded at the bottom, were driven into a gravel bed about five feet and had an average length of 25 feet. They were capped with thick masses of concrete, on which the steel building columns stand.

The site for the J. Clark Keith Generating Station is located on the Detroit River at the southerly limits of the City of Windsor. Coal is received by boat in the summer time, onto a storage area close to the river.

Water for condenser and station use is taken from the Detroit River, passed through the equipment in the station and discharged through an outlet channel downstream from the intake channel. Power from the station leaves on the east by 230 kv. transmission lines, the power from the turbine-generators having been transformed from 13.8 kv. to 115 kv. and from 115 kv. to 230 kv. The total site area comprises 120 acres—85 acres occupied by the station and auxiliary buildings, and a 35-acre

Fig. 2. Richard L. Hearn Generating Station. View looking towards Lake Ontario.



area recently purchased for ash disposal.

The buildings comprise the main equipment building with an annex on the south end for the administration of the station, the control building, one screen house building at the Detroit River, a truck service building and service building for the mobile coal handling equipment.

The main building is again constructed on the unit plan, each building unit housing one steam generator with auxiliaries and one turbine-generator with auxiliaries. Unit No. 1 is on the south and the other units progress to the north.

A control building is located to the east of the main building, adjacent to the switchyard. Steel piles support the concrete structure framed with brick walls—red outside, buff inside, and covered with a concrete roof of light-weight insulating slabs.

The annex provides offices and rooms for the station personnel, laboratory, machine shop, electric shop and storage.

The steel piles, 12-inch, 74-pound H section, were driven to rock at an average depth of 85 feet. They are capped with thick masses of concrete, on which the concrete building columns stand.

Building data is given in Table 1.

TABLE I
Building Data

Building	Item		Richard L. Hearn G.S.	J. Clark Keith G.S.
Annex	Length	Ft.	170	145
	Width	Ft.	48	71
	Height	Ft.	35	45
	Volume	Cu. Ft.	285,600	463,275
	Piles		102	346
	Steel—Rfcg.	Tons	65	407
	Structural	Tons	135	10
	Concrete	Cu. Yds.	1,200	5,150
	Brick	M	76	462

			Turbine Room	Steam Gen. Room	Turbine Room	Steam Gen. Room
Unit	Length	Ft.	112	190	142	129
	Width	Ft.	86	84	58	73
	Height	Ft.	93	139	82	137
	Volume	Cu. Ft.	895,776	2,218,440	675,352	1,290,129
	Total Volume	Cu. Ft.	3,114,216		1,965,481	
	Piles		380	470	638	
	Steel—Rfcg.	Tons	176		935	
	Structural	Tons	1,550		25	
	Concrete	Cu. Yds.	3,700		12,000	
	Brick	M	314		695	
Total Volume of Annex and Unit			3,399,816		2,428,756	

TURBINE GENERATORS

All units comply with A.S.M.E.-A.I.E.E. "Preferred Standards for Large Condensing Steam Turbine-Generators." They were purchased in England and transported by boat and rail direct to the station sites. At the Toronto station—units No. 1 and No. 3 rated 88/100,000 kw. are convertible 25/60 cycle, commencing operation at 25 cycles and 1,500 r.p.m., and later converted to 60-cycle at 1,800 r.p.m. as required by "Frequency Standardization" program. Units No. 2 and No. 4 rated 100,000 kw. are for 60-cycle frequency at 1,800 r.p.m. only. At the Windsor station all four units rated 60/66,000 kw. are for 60-cycle frequency at 3,600 r.p.m. only. The Toronto generators are provided with direct connected exciters. The Windsor exciters are driven at 1,145 r.p.m. from a twin reduction gearing, the other half of which provides the motor connection for starting the generator as a synchronous condenser. All generators are hydrogen-cooled at ½ p.s.i.g. for rated load and 15 p.s.i.g. for overload. The operating conditions of both turbine and generator are indicated on unit boards and the control of such conditions is from control stands.

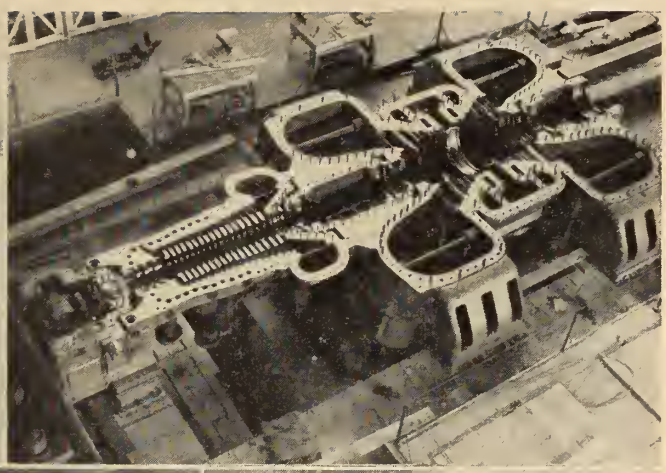
The turbines at Toronto are tandem compound curtis (1) reaction (39) complete with governing, lubrication system and motor-driven turning gear, which turns the rotor at about 30 r.p.m. The rotors were tested at 20 per cent overspeed and the overspeed trip is set at 12½ per cent above normal. The maximum speed rise on rejection of 100 per cent of load is not expected to exceed 10 per cent above normal speed. Two throttle valves with by-pass are provided—one on each side. Five extraction points are provided.

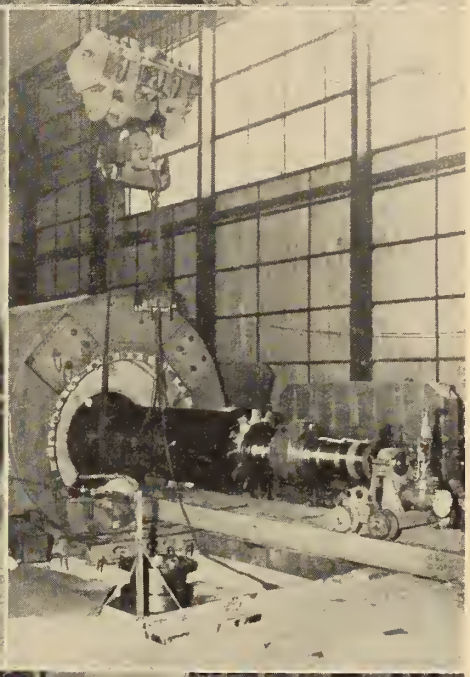
The generators are of the rotating field and stationary armature type and hydrogen-cooled. The windings in both parts are vacuum impregnated. The unit comprises three parts—rotor, stator, and stator casing. The casing is mounted on the sole-plates. The stator slides endways into the casing on special ways. The rotor is slid endways into the stator and end castings make the three pieces tight for 15 p.s.i.g. hydrogen.

The turbines at Windsor are of the two-cylinder tandem compound impulse type. The low-pressure cylinder has two exhaust nozzles, each of which is connected to its own condenser. The turbines are complete with auxiliaries including governing, lubrication and motor-driven turning gear. The rotors were tested to 15 per cent overspeed and the overspeed trip is set at 10 per cent

TABLE II
Turbine Generator and Transformer Data

			Richard L. Hearn G.S.		J. Clark Keith G.S.
No. of units planned			2/2	4	4
Capacity	— Megawatts		88/100	100	60
Steam	— Pressure	Psig	850		850
	Temperature	°F	900		900
	Vacuum	Hg. Abs.	1½		1½
Generation	— Phase		3		3
	Frequency		25/60	60	60
	Voltage	Kv.	11/13.8	13.8	13.8
	Power Factor	%	85		85
	Short Circuit Ratio		.8		.8
Speed	— Rpm.		1,500/1,800	1,800	3600
Main Transformers					
No. per unit			2	1	1
Kva.			43,500	100,000	85,000
Frequency			25	60	60
Volts — Low			10,500	13,200	13,200
High			115,000	115,000	115,000
Phase			3	3	3
Type			Forced air cooled		Forced air cooled





TORONTO

Fig. 3 (top left). Condenser casing on barge leaving Montreal.

Fig. 4 (centre left). End view of generator stator.

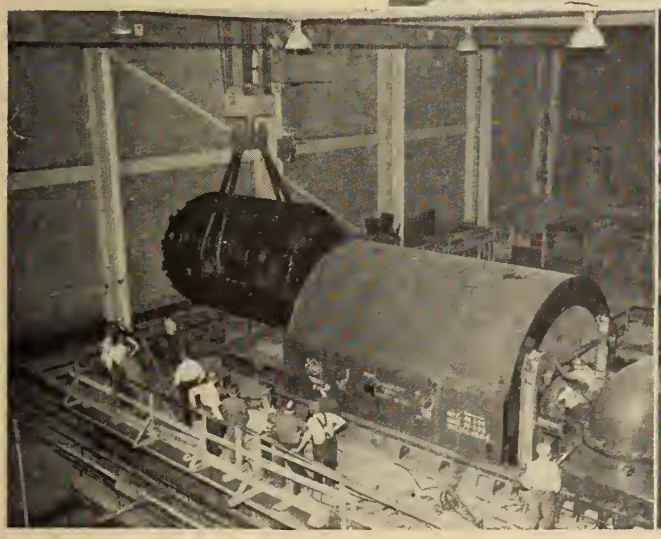
Fig. 5 (bottom left). Crane moving generator stator into casing.

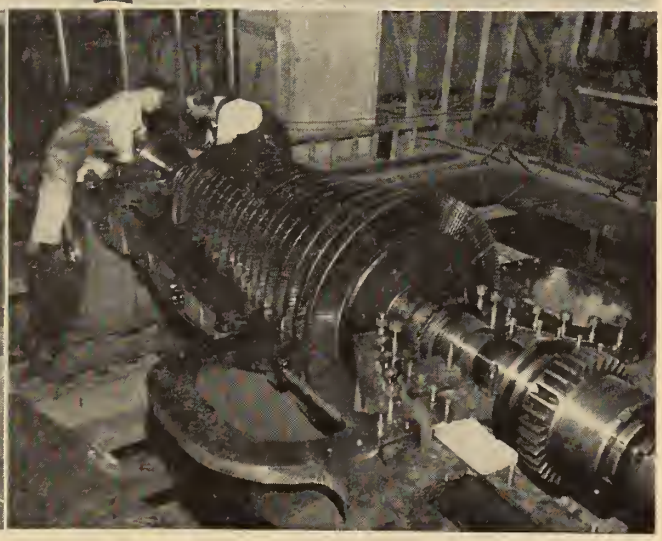
WINDSOR

Fig. 6 (top right). Bottom half of main turbine casing.

Fig. 7 (centre right). Moving rotor into position in generator.

Fig. 8 (bottom right). View of high pressure turbine blading.





above normal. Two throttle valves with by-pass are provided, one on each side, and five extraction points are provided.

The generators are two-pole machines directly connected to the steam turbine through a flexible coupling. The main and pilot exciters are connected to the generator through twin reduction gearing for operation at 1,145 r.p.m. Provision has been made for quickly disconnecting the generator from the turbine for operation of these generators as synchronous condensers when power is not required in the summer months.

Turbine-generator and transformer data are given in Table II.

All generators at Toronto are solidly connected to the low voltage side of the main transformers. The high voltage side connects to a unit power line through two breakers in series. Between these breakers a transfer bus tie with unit breakers is connected to other units. Connections with breakers are made to the bus tie for emergency supply to the station auxiliary bus. Unit auxiliaries are normally supplied from that unit generator, through a transformer to the auxiliary bus. At Windsor, two generators are arranged for quick disconnection from their turbines and operation as synchronous condensers.

Modern metalclad switchgear supplied in sectionalized compartments is used on the low voltage supply to motor-driven auxiliaries and general station service. This compact switchgear is arranged for easy unit removal and replacement, combined with maximum safety. The arrangement provides for readily extending in future as may be required.

The following paragraphs of this section discuss turbine-generator design features which relate to:

(a) Both types in general.
(b) The reaction type in particular.
(c) The impulse type in particular.

(a) Both Types Turbine

The steam is supplied to the high pressure cylinder through two stop valves to two cast steel steam chests arranged symmetrically about the turbine. Each chest is provided with an emergency trip valve and a governing valve. The chests operate in parallel.

Each chest is connected to the high pressure turbine with adequate flexibility in the piping so that pipe thrusts largely cancel out, thus relieving the turbine of any undue thrust loads from this source.

The couplings are of the flexible type with axial float and as each turbine is provided with its own thrust block, differential axial expansions are confined to each individual turbine.

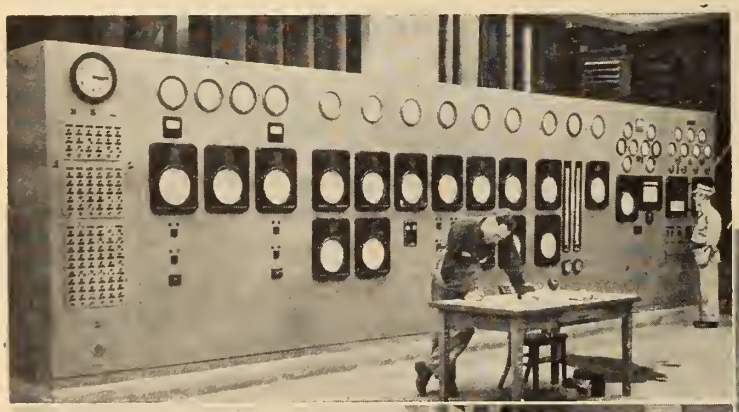
The high pressure thrust block can be moved in an axial direction while the turbine is in operation so that the effects of differential expansions during starting, loading or unloading can be minimized.

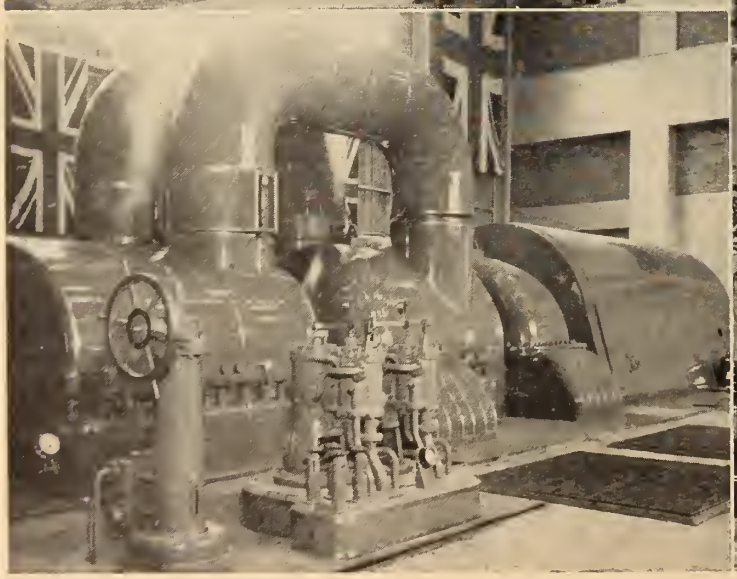
The glands throughout the machines are of the labyrinth type, steam packed, and leakage steam from the high pressure glands is piped back into the high pressure turbine where it performs useful work.

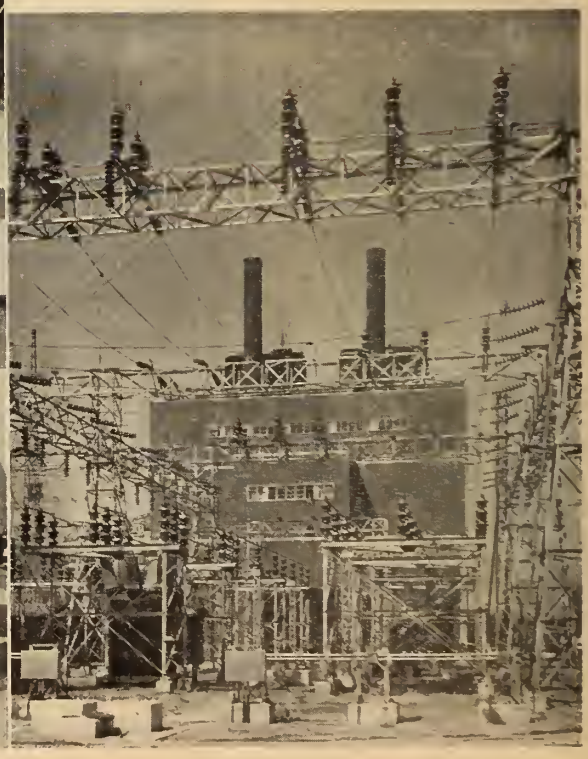
Governing

An hydraulic system of governing and load regulation is employed. A powerful high speed centrifugal governor actuates relays which vary the oil pressure in the main servo motors of the steam control valves.

The emergency governor gear can be actuated by mechanical over-

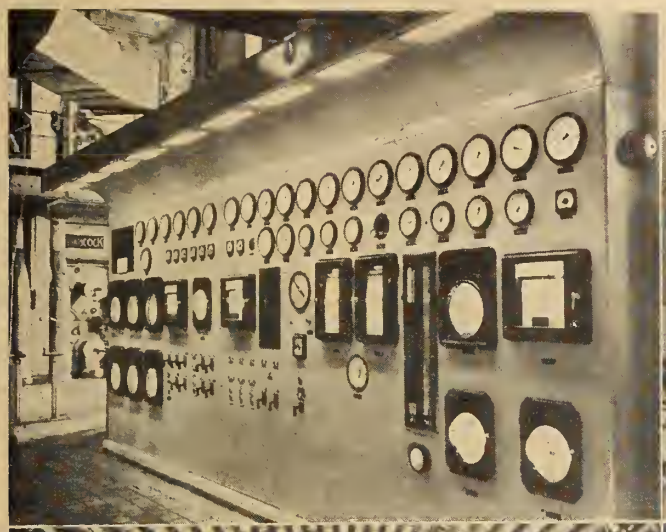


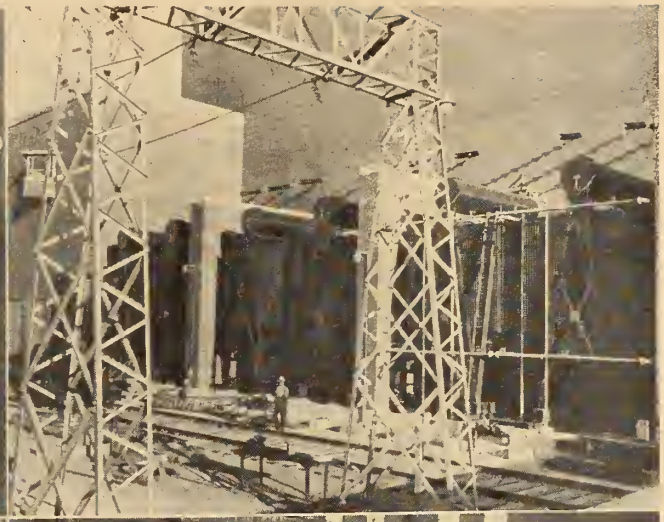




J. Clarke Keith Generating Station

Fig. 9 (upper left). Turbine control board.
Fig. 10 (lower left). No. 2 turbo-generator unit.
Fig. 11 (lower right). View of switchyard with power house in background.





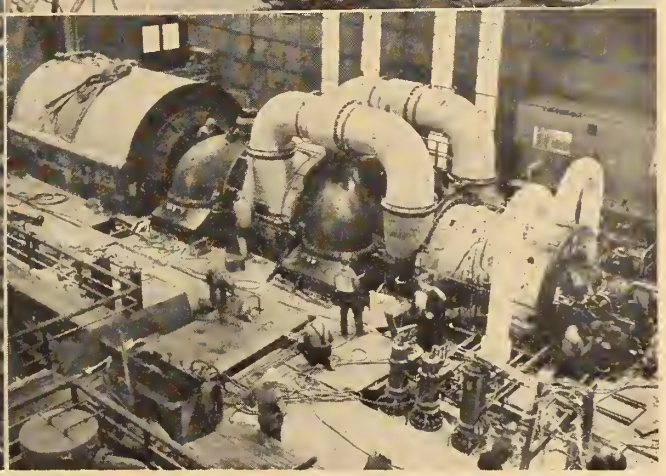


Fig. 12 (top left). Turbine control board.
Fig. 13 (top right). Main transformers.
Fig. 14 (bottom left). Lengthwise view through stator bore.
Fig. 15 (bottom right). No. 2 turbo-generator unit as erection nears completion.

speed governors of the unbalanced ring type, by an electrical overspeed governor, by hand trip at the turbine or by the electrical trip operated from the control room.

Turning Gear

Electric motor driven turning gear is provided in order to reduce to a minimum the risk of the turbine rotors distorting due to uneven heating or cooling whilst the set is not "on steam". The gear is put into operation by hand but is thrown out automatically when the turbine speed under steam exceeds that of the gear.

Generator Stator

The stators consist of the usual type of sheet steel and insulated copper bar windings flexibly mounted inside an outer gas tight housing. The outer housing is of fabricated construction built up of structural steel plate and bar.

The windings are of the conventional basket type transposed internally to minimize eddy currents.

Mounted axially above the core are two gas coolers.

Main Leads

The main leads pass from the stator winding into terminal boxes which are bolted to the under surface of the frame at the slip-ring end. The leads are taken out of the gas-tight housing by means of condenser type bushings. There are three terminal boxes situated side by side, each box enclosing one main and one neutral connection.

Oil Jacking

Oil jacking is fitted to both generator bearings to reduce the starting torque and wear on the white metal at starting. High pressure oil at approximately 2,000 lb. per sq. in. is fed through a non-return valve to two depressions in the lower half of each bearing.

Seal Oil System

The hydrogen seals are supplied with oil which is treated to remove entrained air and water to prevent adulteration of the hydrogen occurring from the oil which flows to the gas side of the fields.

A conventional seal oil treating unit is located at the ground level and contains the various items associated with oil supply to the side.

A separate motor-driven seal oil pump is also supplied for the generator seal oil system when the unit is shut down.

The seal oil pressure is normally maintained at approximately 10 lb. per sq. in. above the alternator gas pressure; thus the ventilating system is made gas tight.

(b) Reaction Type Turbine

The high pressure cylinder comprises a two row impulse wheel followed by twenty-nine stages of reaction blading.

The rotor is of hollow construction in which the rotor body is integral with the extended portion forming the high pressure end of the shaft.

The exhaust end of the rotor is a separate forging extended to form the other end of the rotor shaft. The maker claims that this method of construction enables the metal form-

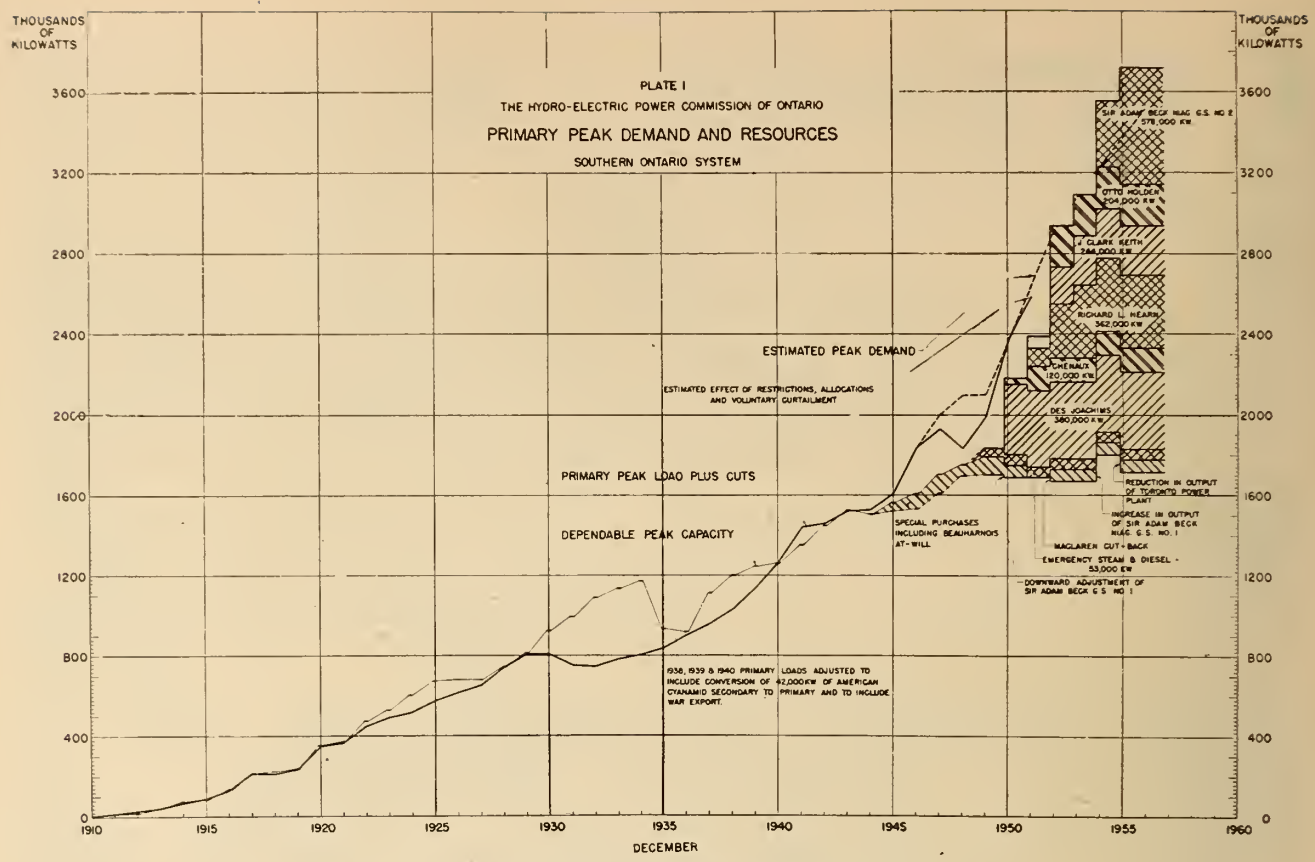


Fig. 16. Chart showing primary peak demand and resources.

ing the body of the rotor to be made comparable in thickness with that of the steel cylinder surrounding it, and thus obviates difficulties due to differential expansion of rotor and casing.

Blading is stainless steel throughout and is of two types known as segmental and integral. In the segmental blading, the individual blades are assembled in groups together with their distance pieces, before being fitted in the turbine, each group consisting of eight to twelve blades and constituting a short arc of the whole circle of blading. The segments are serrated along their roots and they are fixed in the serrated grooves of the turbine by means of side locking strips.

The integral blading is rolled from a billet with its root piece, which serves to form the spacer between the blades.

Segmental blading fitted with a shroud and known as "end tightened" blading is used generally throughout the high-pressure turbine. These blades are used in the low-pressure turbine, the integral blades being used mainly towards the exhaust end where the blades are of considerable length and the stresses correspondingly great. The last two rows of moving blades are fitted with erosion resisting shields.

Low Pressure Cylinder

The rotor is of hollow construction and is built up from three forgings comprising the two ends and the centre drum. The double flow balances the thrust on the blading and no dummy pistons are required.

Turbine Glands

The high and low pressure cylinder glands are of the spring-backed labyrinth type in which the rings are held in contact with the shaft by springs mounted in the recess behind each ring.

They are steam packed from two distribution boxes, one of which supplies the high pressure turbine glands and the other the low pressure turbine glands.

Governor Gear and Lubricating Oil System

There are two sets of oil pumps—main and auxiliary. Each set comprises a high pressure oil pump of small capacity and a low pressure pump of large capacity.

The main pumps of the gear type are driven from the high pressure turbine shaft through a worm and gear wheel housed with the governor in the high pressure steam end bearing pedestal.

The high pressure oil pump supplies oil to the governor pilot system, and power oil to the governor valve relays; it also provides oil at a suitable pressure from which the generator shaft seals are normally supplied.

The entire supply of low pressure oil is used for lubricating the bearings and thrusts.

An auxiliary oil pump is steam turbine driven and comprises a gear and a centrifugal pump which are for use when starting or stopping the main turbine or in an emergency. As in the case of the main oil pump the gear element supplies oil at a pressure of 70 lb. per sq. in. for operating the valve gear and provides a source of supply for the generator seal oil system.

The centrifugal element delivers oil at a pressure of 15 lb. sq. in. for lubricating the bearings and thrusts.

This pump is controlled by a regulator which automatically starts the pump when the bearing oil pressure falls below a predetermined value.

An additional motor driven oil pump is supplied for use when the unit is on the turning gear, that is

when steam is not available for the turbine driven auxiliary oil pumps.

Generators
Rotors for Dual Frequency (Nos. 1 and 3)

Two rotors have been supplied, one having two poles and operating at 1,500 r.p.m. to give a 25-cycle frequency and the other having four poles and operating at 1,800 r.p.m. to give the 60-cycle frequency.

The rotor bearings are external to the explosion-proof casing, the turbine end bearing being carried in the exhaust casing pedestal and the exciter end bearing on a separate pedestal.

The exciters are directly coupled and are provided with a torsion rod drive.

(c) Impulse Type Turbine

The high pressure cylinder has blading of the impulse type. The rotor is machined out of a solid forging and the steel diaphragms are of built up construction.

The low pressure cylinder is provided with reaction blading except at the inlet where a double flow impulse stage enables a considerable heat drop to be utilized without leakage losses.

The double flow low pressure rotor is of built up construction consisting of forged steel discs shrunk onto the shaft, with the blading mounted on the discs.

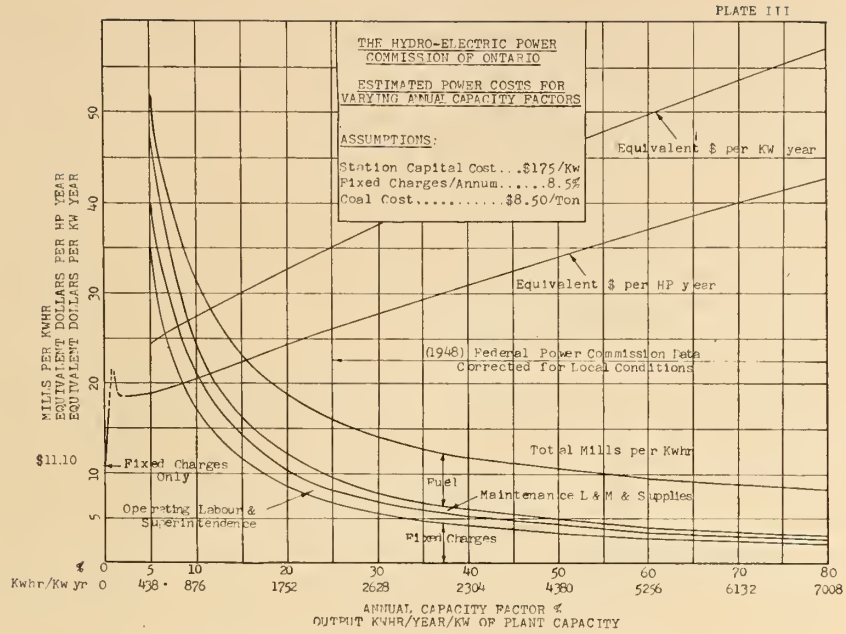


Fig. 18. Chart showing estimated power costs.

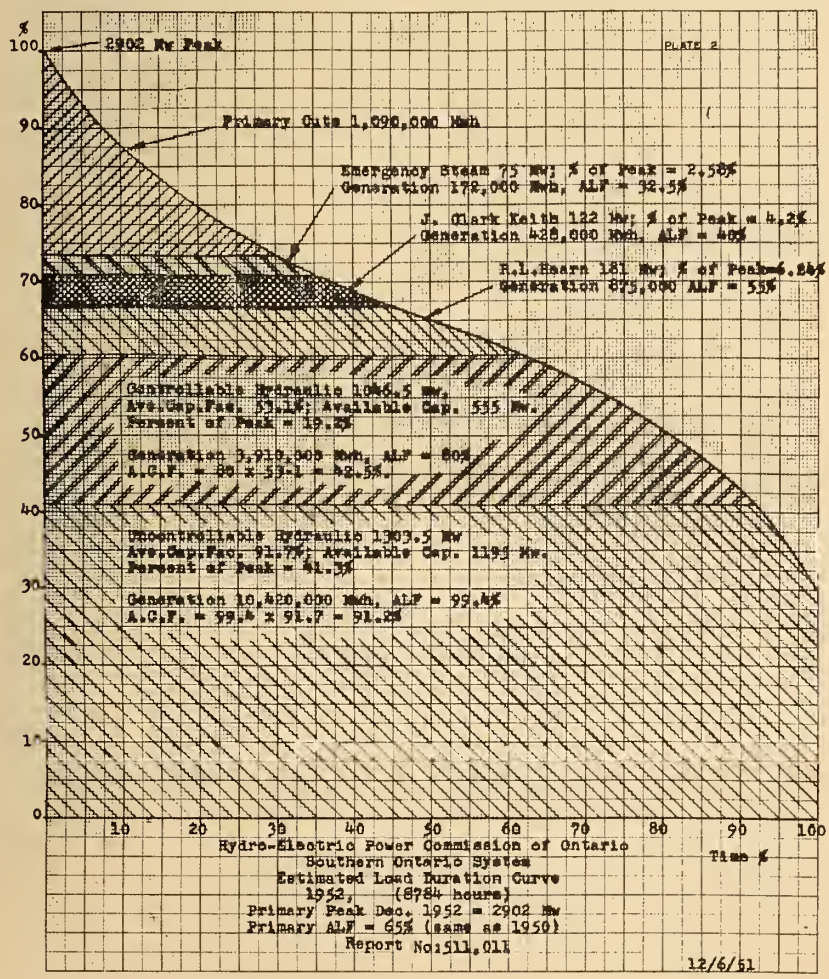


Fig. 17. Estimated load duration curve.

Blading and Glands

The blading is of stainless steel throughout with the exception of the last two rows on the low pressure rotor which are of manganese nickel steel, chromium plated; this steel withstands the heating necessary when attaching lacing wires by silver soldering. Stellite shields are provided to prevent erosion of the blades by moisture in the steam.

The blade fixings are of various types suited to the stresses. The fixings of the long blades of the last two rows on the low pressure turbine are of the "side entry" type. Each blade root is held in a separate groove in the disc head, the grooves being cut across the head in an approximately axial direction. Thus bending stresses in the blade root and the disc head are virtually eliminated.

Governing

When the machine is tripped out the emergency valves and the governing valves are closed, non-return valves on the high pressure bled steam lines are closed electrically, thus preventing reverse flow of high pressure steam into the turbine.

Lubricating

The system comprises an oil tank, a main oil pump housed in the high pressure front pedestal and driven from the main turbine shaft through helical gearing, and one turbine

driven impeller type pump. This is a full duty pump for use when starting up and shutting down and in emergencies. It is automatically controlled to come into action or shut down when the oil pressure in the main relay system falls below 42 lb. per sq. in.

The next auxiliary pump is a-c. motor driven. This pump supplies oil for lubrication purposes only and is automatically brought into action when the pressure of the oil to the bearings falls below a certain value. Alarm signals are given when each of these two pumps is brought into service automatically.

The third auxiliary pump is for use during turning periods and supplies oil for lubrication only. It is d-c. motor driven from the station battery and hand controlled.

Each unit oil system also contains an oil jacking pump for starting and three 50 per cent duty oil coolers.

Oil is drawn from the tank and delivered through a non return-valve to a distribution box. This box is fitted with a relief valve set at about 60 lb. per sq. in. through which surplus oil returns to the tank. Oil under full pressure is supplied to the governor relay gear from the distribution box.

Oil for lubricating purposes is passed through a pressure reducing valve to the coolers and thence to the bearings at a pressure of about 15 lb. per sq. in.

Seal Oil System

The hydrogen seals are supplied with oil which is normally vacuum treated to remove entrained air and water in order to prevent adulteration of the hydrogen occurring from the oil which flows to the gas side of the seals.

A seal oil treating unit is located at ground level and contains the various items associated with oil supply to the seals.

This unit consists of a welded steel cylinder divided into two sections, one of which is an oil reservoir and the other a vacuum tank together with two oil pumps, a vacuum pump, a pressure control valve and the automatic alarms.

The seal system uses turbine lubricating oil, a make-up or discharge connection being made to the main bearing drain so that the quantity of oil in the reservoir is automatically kept constant although some small interchange between the bearing and seal system may take place by creepage along the shaft between the bearing and the air side of the seals.

Normally oil is fed to the seals by the main seal oil pump which is driven by an a-c. motor. The pressure at the seals is automatically maintained at about 10 lb. per sq. in. above the hydrogen pressure in the frame, whatever it may be, by means of a differential pressure regulator responsive to gas and oil pressures; control of the pressure is effected by varying the proportion of the pump output which is by-passed to the vacuum tank or to the reservoir if the oil is not being vacuum treated.

After leaving the pump the oil is passed through a cooler and thence through self-cleaning filters to the seals.

Oil draining from the hydrogen side of the shaft seals is taken to the defoaming tanks located under the outer frame where it is allowed to settle, the hydrogen which comes out of the foam being returned to the frame.

One defoaming tank is provided for each seal to avoid the possibility of oil vapour being circulated through the machine due to any slight difference between the characteristics of the two rotor fans.

The level of oil in the defoaming tanks is maintained by a float valve which ensures that under all conditions of flow a gas seal is provided at this point.

The oil from the defoaming tanks is taken directly to the vacuum tank through a float valve, while that from the air side of the seals is drained into the top of the reservoir tank.

Oil from the bottom of the reservoir then enters the vacuum tank with the gas side oil from the defoaming tanks. This method ensures that the oil in the reservoir is kept in circulation.

Provision is made for by-passing the vacuum tank for maintenance purposes without taking the unit out of service. In this case the pump draws directly from the seal oil reservoir and the gas side as well as the air side seal oil is returned to the reservoir. Operation in this way can be continuous but the consumption of hydrogen will be increased because of the necessity of admitting more gas to compensate for the infiltration of air through the medium of the untreated oil.

If the pressure of the oil at the alternator seals should drop, due for example to the failure of the main pump, differential pressure switches responsive to both gas and oil pressures bring in the standby oil pump. This pump is driven by a d-c. motor deriving its supply from the station battery. The oil pressure it provides is determined by a relief valve. This is pre-set to give a pressure at the generator seals of 10 lb. per sq. in. above the maximum pressure at which the set will be operated.

As a precaution against the failure of both motor driven pumps a back-up oil supply for the seals is taken directly from the main bearing supply of the set.

In order to prevent any possibility of pockets of hydrogen collecting anywhere in the lubrication system of the set a vapour extractor is provided on the main oil tank to maintain a slight degree of vacuum above the oil and thus ventilate the oil pipes and tanks.

STEAM GENERATORS

These modern steam generators comprise superheater, steam and mud drum with tubes, water walls and economizer, with required soot-blowers.

They are of the radiant type, two-drum, without gas baffles; designed for a working pressure of 1,000 p.s.i.g. to the A.S.M.E. code.

The steam drum is separated into two compartments by a manifold for the cyclone steam separators, the outer of which collects and confines the steam and water mixture rising from the generating tubes, delivering it to the cyclone separators, which release the dried steam to the superheaters and the solid water free from steam bubbles returns quietly to the inner compartment of the drum for return to the generating water wall tubes.

The burner wall is of tangent tube construction, the tubes being bent to form circular openings for the burners. At the burner openings the tubes are studded and covered with chrome refractory to provide a durable gas-tight ignition zone not dependent on refractory for strength.

The steam generator is supported by overhead beams allowing the main expansion to take place in a downward direction. The main steam drum is hung by means of two heavy multiple "U" straps.

The wall tubes are insulated on the outside by means of refractory tile and 85 per cent magnesia block which is held in place by means of

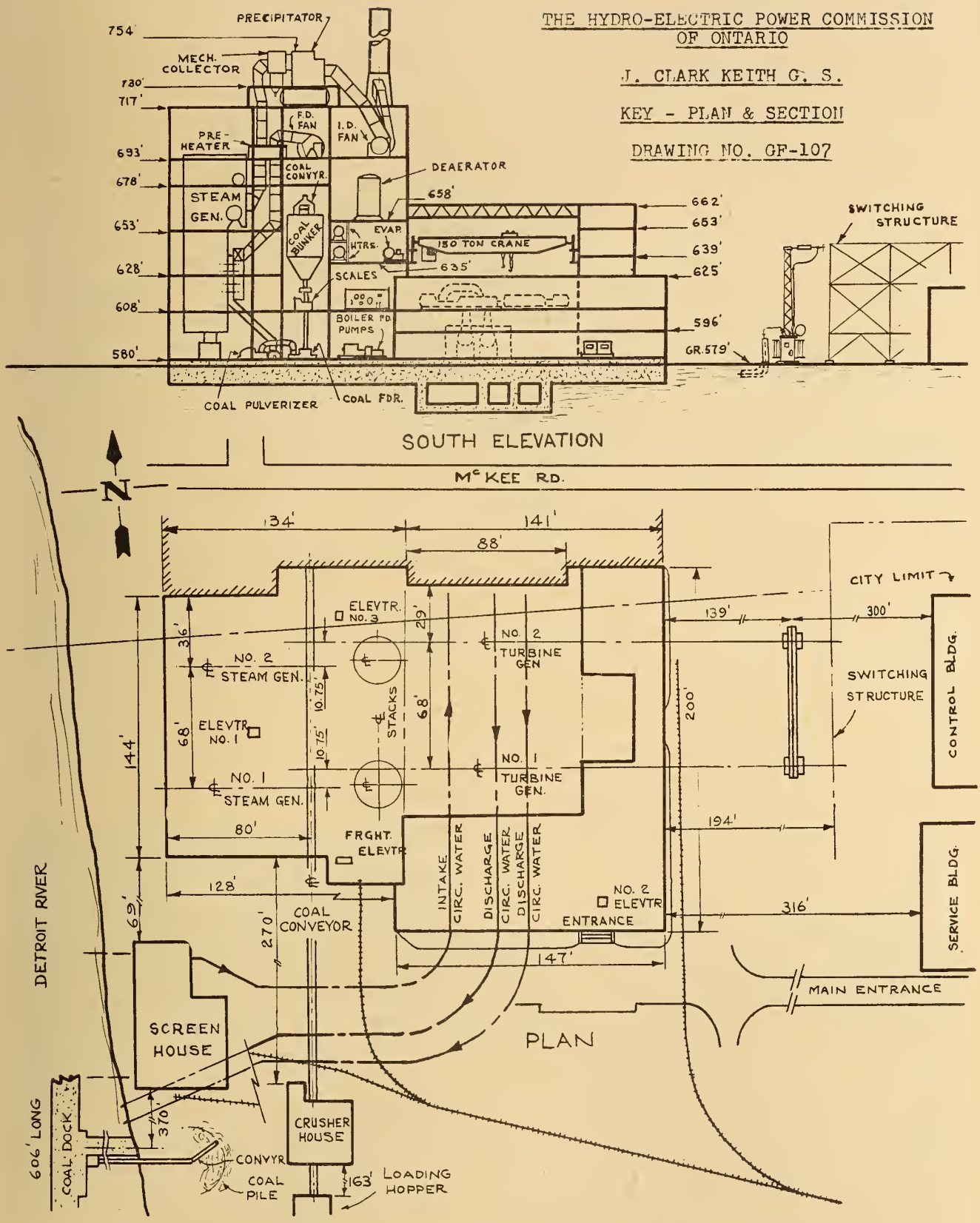


Fig. 19. Plan and elevation, J. Clark Keith Generating Station.

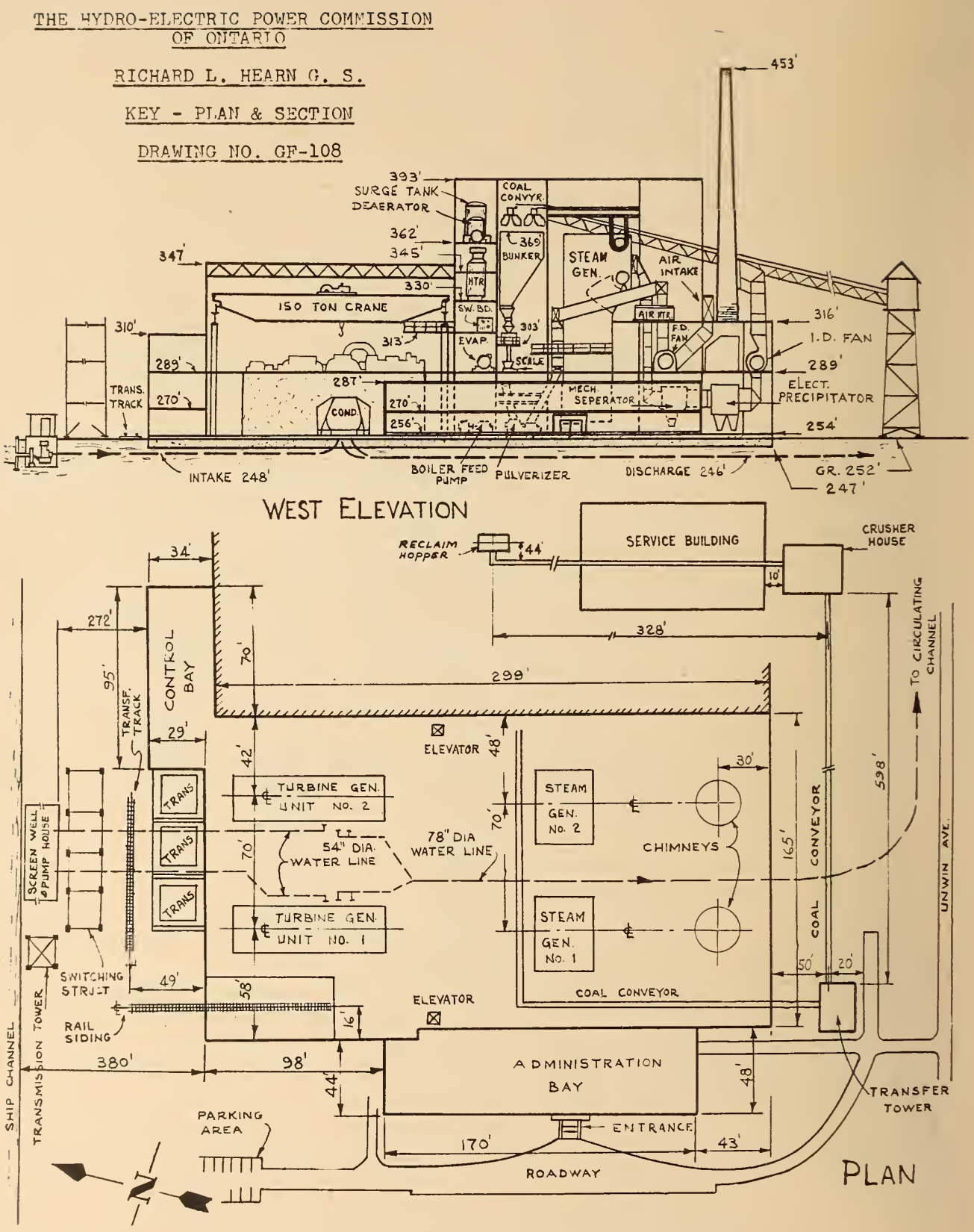


Fig. 20. Plan and elevation, Richard L. Hearn Generating Station.

TABLE III
Steam Generators Data

	Richard L. Hearn G.S.	J. Clark Keith G.S.
Capacity		
Steam.....Pds./Hr.	850,000	650,000
Pressure.....P.s.i.g.	850	850
Temperature.....°F	900	900
Heating Surface Sq. Ft.		
Steaming Tubes.....	37,080	34,590
Water Wall.....	12,000	9,780
Superheater.....	19,600	17,570
Economizer.....	9,500	8,450
Total.....	78,180	70,390
Steam Drum		
Diameter.....	66″	66″
Length.....	48′–4⅞″	46′–6″
Height c/l above basement floor.....	114′–9″	97′–9″
Bottom Drum		
Diameter.....	40′–⅛″	42″
Length.....	43′–6″	44′–6″
Height c/l above floor.....	93′–6″	76′–6″
c/l of Steam Drum to c/l of Bottom Drum...	21′–3″	21′–3″
Projected area of Water Wall Tubes Sq. Ft.		
Sides.....	3,480	2,940
Target Wall, Hopper and Roof.....	4,240	3,380
Burner Wall, Hopper and Screen.....	4,280	3,460
Total.....	12,000	9,780
Furnace		
Width c/l to c/l side walls.....	40′–0″	36′–0″
Depth c/l to c/l front and rear walls.....	24′–0″	24′–0″
Volume Cu. Ft.....	69,600	52,500
Heat Release BTU/Hr./CuFt. @ Full Load..	15,550	14,970
Heat Release BTU/Hr./Sq.Ft. Projected Area.....	60,000	80,300
Tubes		
Steaming Tubes OD × wall.....	2″ × 0.135″	2″ × 0.135″
Material Specification.....	SA–210 Seamless	SA–210 Stainless
Water Wall Tubes OD × wall.....	3″ × 0 180″	3″ × 0.180″
Material Specification.....	SA–210 Seamless	SA–210 Stainless
Superheater Tubes OD × wall.....	2″ × 0.165″	2″ × 0.165″
Material Specification:		
1st stage and ⅓ of 2nd stage.....	SA–210	SA–210
⅓ of 2nd stage.....	SA–209 Alloy	SA–209 Alloy
⅓ of 2nd stage.....	Croloy–2	SA–213 Alloy
Economizer Tubes OD × wall.....	1½″ × 0.150″	1½″ × 0.150″
Material Specifications.....	SA–178–A	SA– 83

studs welded to the tubes. The whole unit is enclosed in a No. 10 gauge steel casing properly braced with buckstays and stiffeners.

Economizer

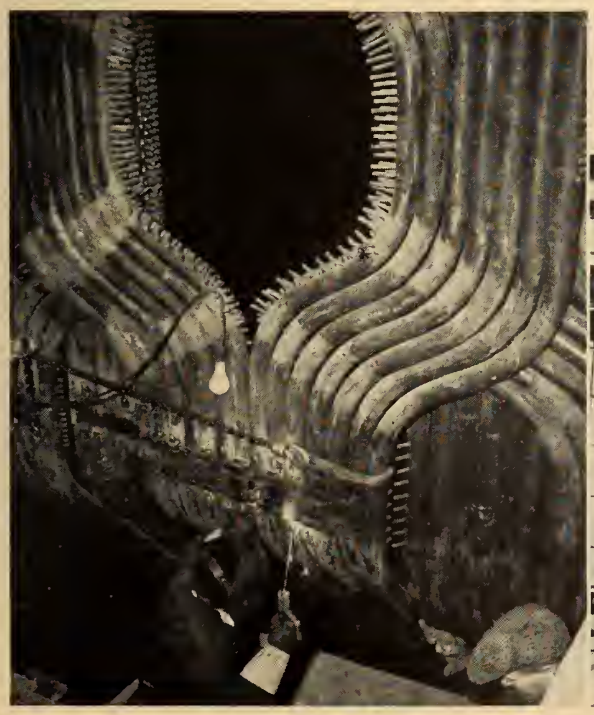
This heating surface is formed into horizontal loops, each end of which is expanded into inlet and outlet headers. Both inlet and outlet headers are 7½ in. square 1¼ in. thick seamless steel. Both the inlet and outlet headers have 6-in. welded connections. The headers are provided with a hand hole for every tube.

Superheater

This is a two-stage, parallel flow pendant type with attemperator. Heating surface of 2-in. O.D., 0.165-in.-thick tubes is welded directly to necks on the headers.

While the superheater surface is placed so that it receives heat both by radiation and convection, it is predominantly a convection superheater, and therefore tends to produce increasing steam temperature with increasing load. In order to permit operation at 900 deg. F. at all loads between 60 and 100 per cent an interstage spray type "attemperator" is installed. The "attemperator" water requirement is approximately 100 I.g.p.m. at 885 p.s.i.g. and 400 deg. F. at the attemperator inlets using evaporated feed water or condensate supplied as feed to the steam generator. The main steam outlet from the superheater is a welding neck located at the centre of the outlet header.

Steam generator data is given in Table III.



J. Clark Keith Generating Station

Fig. 21 (left). View of front wall boiler tubes, showing burner opening.

Fig. 22 (right). View of steam and rear wall boiler tubes.

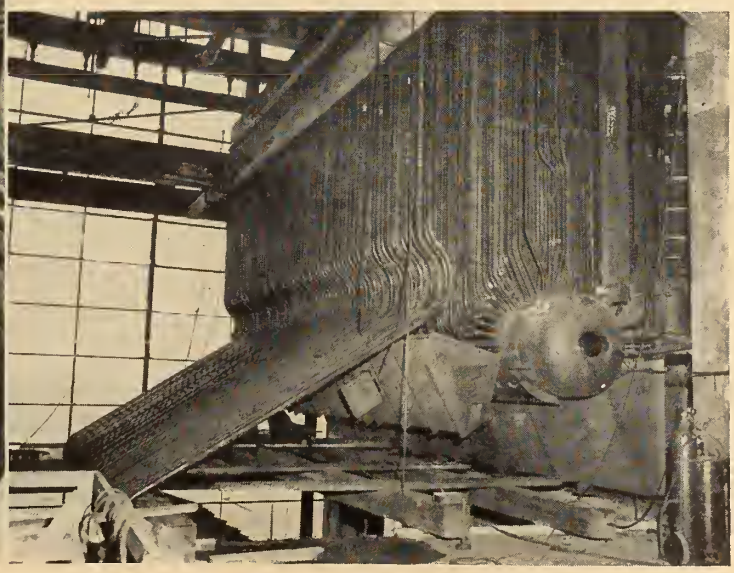


Fig. 23. Hoisting boiler drum into position.

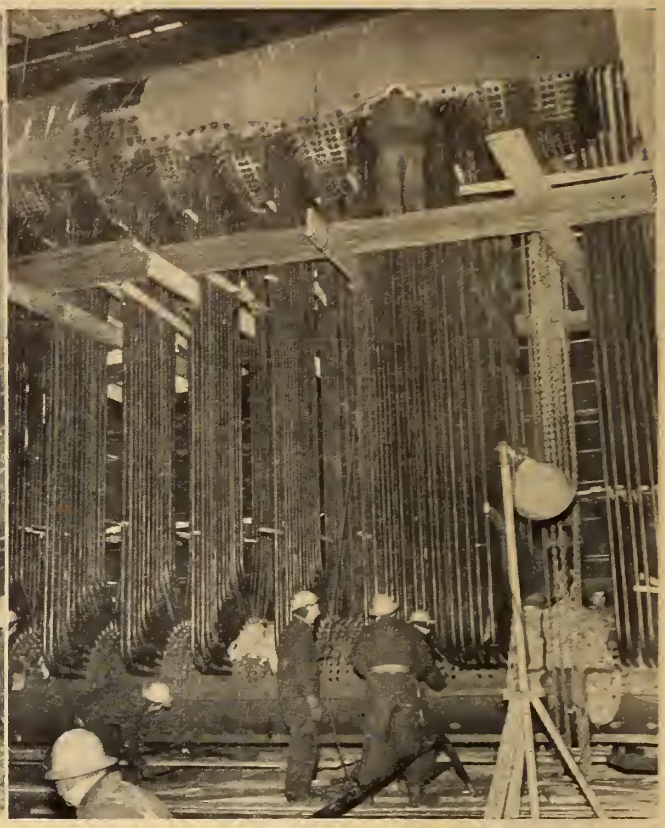


Fig. 24. View showing installation of boiler tubes.

COMBUSTION AND COMBUSTION EQUIPMENT

Forced Draught Fans—Two per unit

The primary and secondary air for combustion is drawn from the outside by two double width, double inlet, high speed forced draught fans, provided with outlet louvre dampers and driven by squirrel-cage induction motors.

Air Preheater—Two per unit

The air from the forced draught fans passes through ducts into two regenerative type air preheaters and then into the insulated burner box. The preheaters are of the vertical surface rotating type having heating surface of vertical crimped steel sheets, between which the hot gases from the economizer pass upward, giving up heat to the crimped sheets on one side of the heater. The air from the forced draught fan passes in the opposite direction on the other side of the heater absorbing the heat given up by the hot gases. The turning of the vertical heating surfaces from hot to cold causes a continuous transfer of heat from the hot gases to the cold air.

The power for driving the rotor is transmitted from a motor to a bevel pinion shaft through a speed reduction gear. Provision is made for cleaning the heating surface by steam or air nozzles which are mounted on a swinging arm. Seals are provided to prevent the mixing of hot gases and cold air and also prevent air leakage to the room.

Primary Air Fans—Four per unit

Part of the hot air in the burner box passes into the primary air fan, which increases the pressure and forces the air through the coal pulverizers to pick up the finely pulverized coal and force it through pipes into the burners.

There are four primary air fans for each steam generator, one for each pulverizer. These are heavy duty fans with built-in dampers for control of the pulverizer output. The temperature of the air may be varied as required by the moisture in the raw coal. This is accomplished by admitting cool air. Each fan is driven by a squirrel-cage induction motor. The fans are insulated to prevent loss of heat from the air.

Pulverizers—Four per unit

Raw coal from the coal bunkers passes down four chutes to automatic coal scales, which weigh out batches and discharge them to feeders on the coal pulverizers.

The pulverizers are of the ball and race type, the upper race (or ring) being spring-loaded, the lower race is mounted on the back of a large bevel gear; the bevel pinion driving this gear is mounted on a shaft which extends outside of the housing for direct connection to an a-c. motor.

Hot air from the primary air fans enters the pulverizer and picks up the finely ground coal carrying it up through the centrifugal separator into the coal transport pipes. Any coarse particles of coal are removed in the separator and returned to the pulverizing element.

The fineness of the coal depends on the grindability of the coal and also on the rate of coal feed.

Each pulverizer is direct-driven by a high starting torque squirrel-cage induction motor.

Burners

The burners are adapted to burn either pulverized coal or fuel oil. The burner pipe extends through the burner box (wind box) and is enclosed in an air inlet casing in which are tangential doors or registers, operated from the outside. These doors admit the secondary air in a swirling motion and cause turbulence in the primary air and pulverized coal mixture at the discharge of the burner pipe. The outside of the burner pipes ends in an elbow to which the coal transport pipe is connected.

The burners are located in two horizontal rows across the front of

the steam generator. Each pulverizer furnishes coal to three or four burners.

When burning fuel oil, the oil pipe passes axially through the burner pipe where an atomizing nozzle and stationary impeller mix the fuel oil with the secondary air.

Each pulverized coal burner is provided with an automatic lighting-up torch. This is a mechanical atomizing type with retractable gear and retractable 10,000-volt electric ignition, both of which are operated by a pneumatic cylinder.

Induced Draught Fans—Two per unit

The burnt gases are drawn from the steam generator by double width, double inlet fans, with inlet boxes and outlet dampers, water-cooled sleeve bearings driven by an induction motor.

Combustion

The pulverized coal burns in suspension in the furnace where most of the radiant heat from the burning coal is absorbed by the furnace wall tubes.

The hot gases pass from the furnace through the superheater and convection boiler sections, the economizer and air preheater where the convection heat is absorbed. The gases are drawn through the air preheater, through a mechanical dust collector and electrostatic precipitator by two induced draught fans, and discharged into brick chimneys or steel stacks lined with gunnite. The temperature of the gases discharged to the stack at full load is about 300 deg. F.

Pneumatic automatic combustion control and remote manual control equipment is provided. It is designed to control fuel feed and induced draught in parallel from master impulses of steam pressure and steam flow with the induced draught receiving a secondary corrective impulse from the steam flow air flow relationship and maintains the correct excess air conditions. Furnace draught is maintained constant by control of the forced draught.

Each unit system is also designed to provide semi-automatic control from the master selector valve, remote manual control from individual selector valves, and direct manual control in the event of failure of the power medium.

Combustion equipment data is given in Table IV.

Fly Ash

As the pulverized coal is burned in suspension the ash residue is also in suspension. The heavier particles of ash fall into the furnace ash hopper, which is full of water during ash removal operation and is connected to the furnace bottom by a water seal. The lighter particles of ash are deposited in the dry hopper under the mechanical collectors and electrostatic precipitators.

The gases pass first through the multi-tube centrifugal type mechanical collectors, and then through the electrostatic precipitators in series. The draught loss through the

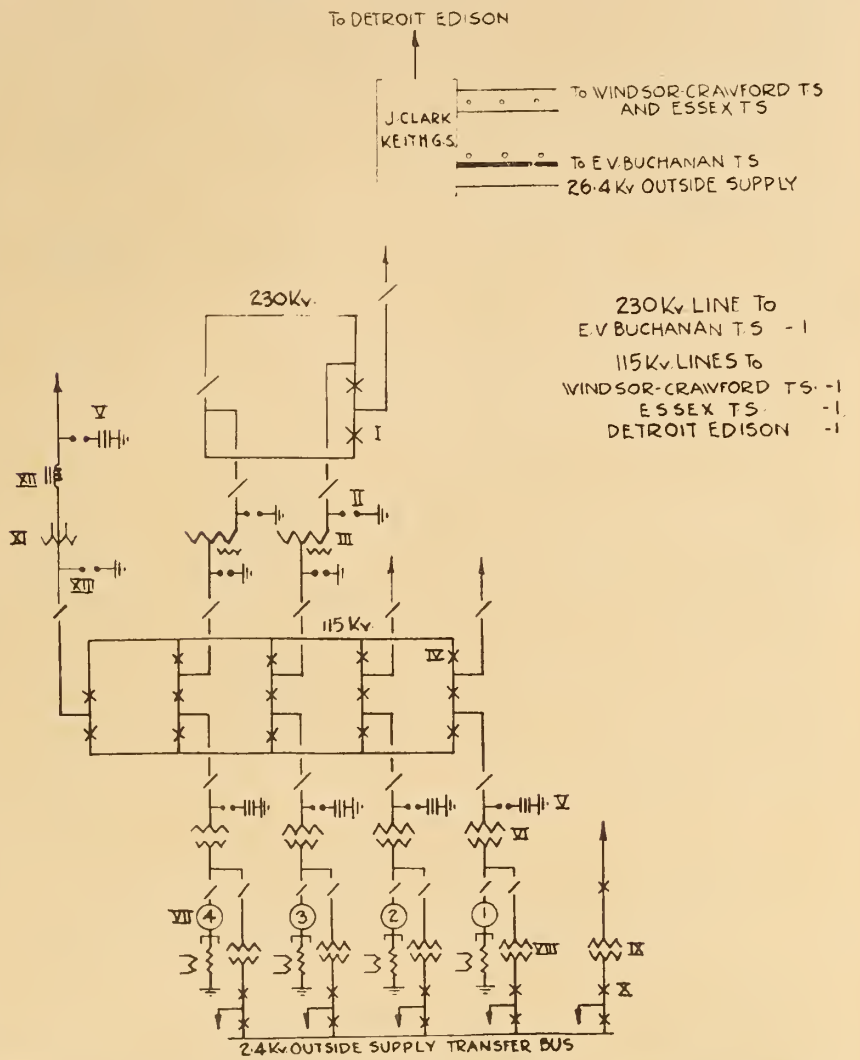


Fig. 25. J. Clark Keith Generating Station. Schematic single line diagram of four-unit station.

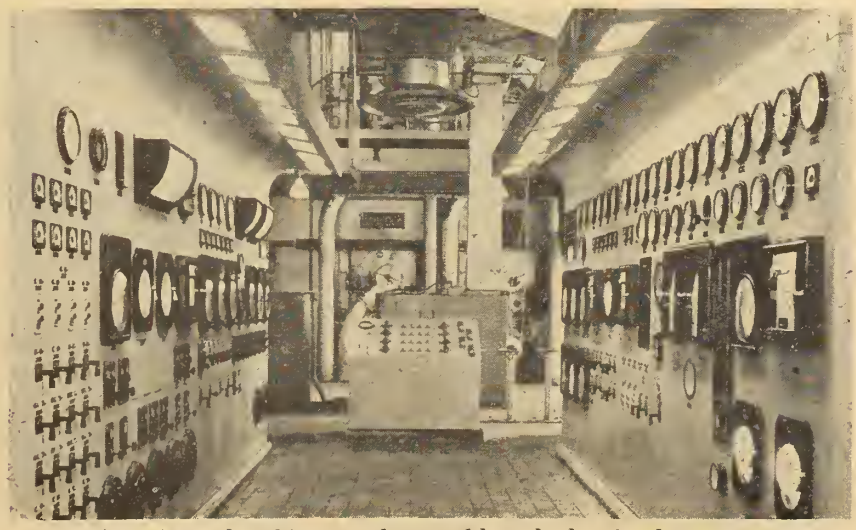


Fig. 26. Boiler and turbine panel control boards showing burner control in centre.

TABLE IV

Combustion and Ash Handling Equipment Data

		Richard L. Hearn G.S.	J. Clark Keith G.S.
Forced Draft Fans—Two per unit			
Capacity	C.F.M.	145,000	85,250
Capacity	Pds./Hr.	620,000	376,000
Static	W.G.	10.8″	5.45″
Speed	R.P.M.	870	693
Drive Type		Direct	Fluid Coupling
Damper Control		Inlet and Outlet	Outlet
Motor	H.P.	350	200
Air Preheater—Two per unit			
Heating Surface	Sq.Ft.	82,600	68,400
Drive	H.P.	7½	5
Primary Air Fans—Four per unit			
Speed	R.P.M.	1,800	1,800
Control		Automatic	Automatic
Motor	H.P.	125	100
Pulverizers—Four per unit			
Drive		Direct	Direct
Motor	H.P.	150	100
Speed		600	600
Burners			
Number per unit		16	12
Induced Draught Fans—Two per unit			
Capacity	C.F.M.	218,000	167,700
Capacity	Lbs./Hr.	725,000	—
Static	W.G.	12.2″	11.5″
Temperature Gases		285°F.	340°F.
Speed	R.P.M.	590	850
Drive Type		Direct	Fluid Coupling
Damper Control		Inlet	Outlet
Motor H.P.		600	450
Motor Speed		600	900
Gas Discharged by:		Radial Brick Chimney	Steel Stack
Diameter	Ft.	21	13
Height above grade	Ft.	203	219

TABLE V

Combined Mechanical and Electrostatic Fly Ash Collector

Location of Hoppers	Richard L. Hearn G.S.	J. Clark Keith G.S.
Mechanical Section		
No. per collector	6	4
Total Capacity Cu. Ft.	2,196	1,552
Precipitator Section		
No. per precipitator	8	8
Total Capacity Cu. Ft.	3,000	2,500

series combination will be about 3-in. w.g. at full load. The guaranteed efficiency of the combination is not less than 96 per cent. The collectors and precipitators are equipped with hopper bottoms having sufficient capacity for the dry storage of the fly ash resulting from twelve hours' operation.

Basically ash handling may be divided into two operations, the furnace bottom ash removal and the fly ash removal. There is one furnace bottom ash hopper to each furnace, fabricated of steel plate and lined with refractory, which is flooded with water except during removal operations. Dry fly ash hoppers are located ahead of and after the boiler mud drum, under the mechanical collector, under the electrostatic precipitator and in the base of the stack.

Ash is removed from the furnace bottom ash hopper through a hydraulically-operated gate which opens when dumping. Jets move the mass of ash and water in the hopper through a grating into a pit. Jet "pulsion" nozzles powered by high pressure water move the ash and water through a pipe line to the ash disposal area.

A single hopper is provided near the pulverizers where pyrites may be dumped and a jet "pulsion" nozzle will pump the pyrites into the boiler ash hopper where they will be removed to the disposal area along with the furnace bottom ash.

The fly ash is removed through pneumatic remote operated valves from the various ash hoppers in the gas passages and precipitators by means of a vacuum created by a water jet, and passes to the pipe lines.

The air-fly ash mixture passes

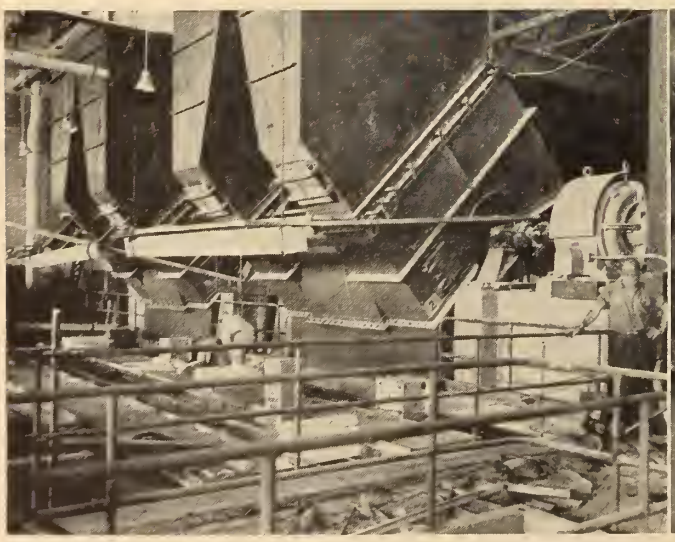


Fig. 27. Forced-draught fans at Richard L. Hearn Station.

Fig. 28. Forced-draught fans at J. Clark Keith Station.

through the vacuum-producing water jet to a separator high in the station, where the air is removed and vented while the water-fly ash mixture strains by gravity all the way to the disposal area.

Surface condensers of the single-shell, two-pass type are in use at Toronto, but two-shell, one-pass type are in use at Windsor. Vertical condensing water pumps are used at both stations. At Toronto, three similar pumps are provided for two main unit condensers—two are sufficient for two turbines at maximum output, the other is stand-by. At Windsor, two similar pumps are provided for each main unit two-shell condenser. Both pumps are required for maximum turbine output.

Revolving screens and chlorination are provided at both stations.

All turbines are provided with five bleed points for feed heating. At Toronto four points are in use, but at Windsor all five points are in use. Vertical motor-driven condensate pumps extract the condensate from the condenser hot-well. Motor-driven horizontal heater drip pumps and motor-driven boiler feed pumps are used at both stations. Horizontal split feed pumps—three per boiler, two sufficient for maximum steam load, one stand-by, are used at Toronto, while vertical split pumps—two per boiler, one sufficient for maximum steam load, one stand-by—are used at Windsor.

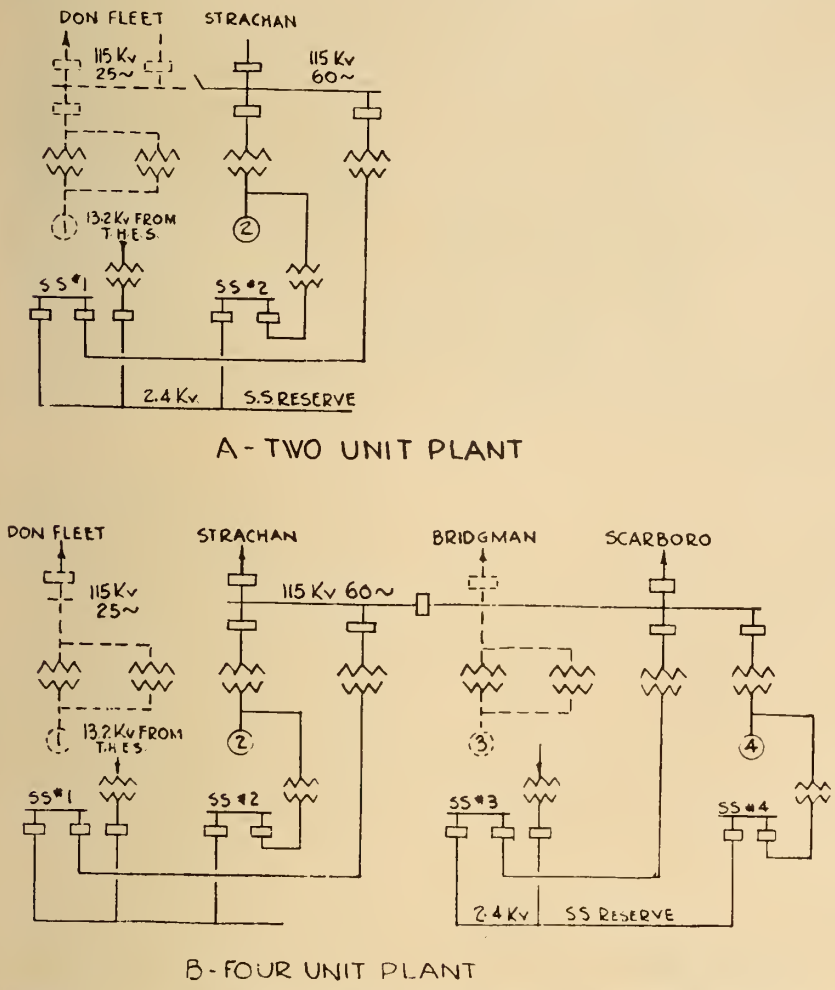


Fig. 29. Richard L. Hearn Generating Station. Schematic single line diagram, showing arrangement for two and four units.

Regenerative Feed Water Heating

By this method of feed heating, certain quantities of steam are extracted at points of decreasing pressure and temperature from the turbine, and the heat of this extracted steam is used to progressively raise the temperature of the feed water on its return to the steam generator, all of which results in a decrease in the amount of fuel required to deliver a kilowatt hour of electrical energy.

Five fixed bands around each turbine are provided and the steam

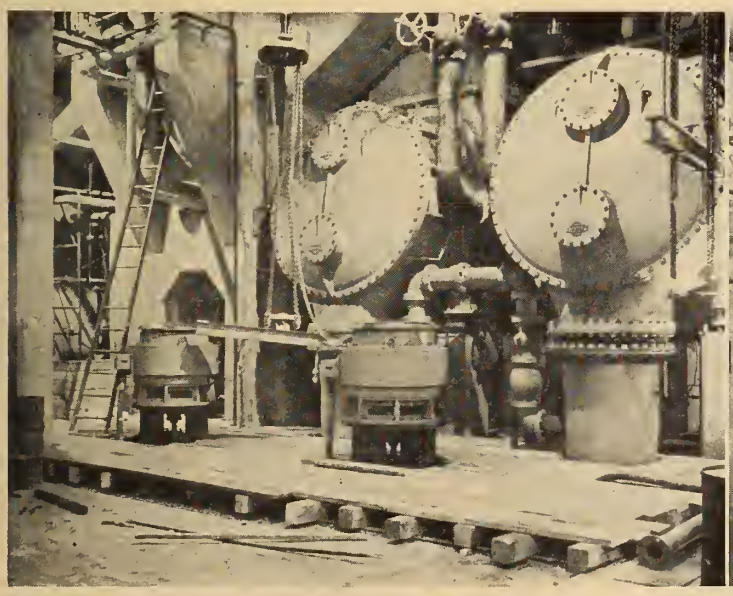


Fig. 30. View of condensers and pumps at Richard L. Hearn Station.

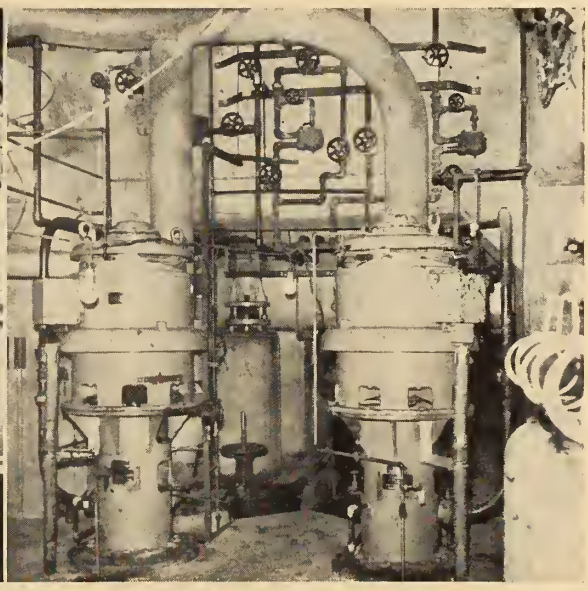


Fig. 31. Condensate pumps with connecting piping.

TABLE VI

Condenser and Feed Water Data

		Richard L. Hearn G.S.	J. Clark Keith G.S.
Condensers			
Capacity	Lbs./Hr.	620,000	400,000
Cooling Water	G.P.M.	52,000	54,000
Surface	Sq.Ft.	60,000	27,500
Tubes	No.	10,000	5,540
Size OD and Gauge No.	B.W.G.	⅞″ and No. 18	⅞″ and No. 18
Effective Length	Ft.	26	21–9½
Circulating Water Pumps			
Capacity	G.P.M.	36,000	28,300
Total Head	Ft.	32	14
Speed	R.P.M.	390	690
Boiler Feed Pumps			
Capacity	Lbs./Hr. ea.	500,000	750,000
G.P.M.		1,833	1,250
Total Head	Ft.	2,630	2,680
Feed Water Temperature	°F.	421	418

from these bands is piped to a heater suitable for the pressure at each band. The steam in each heater is cooled to condensate by the transfer of the heat in the steam to the feed water passing through on its way to the steam generator. The condensate so formed is put back into the feed water at a lower pressure and temperature in the cycle.

TABLE VII

Auxiliaries Data

		Richard L. Hearn G.S.	J. Clark Keith G.S.
Service Water Booster Pump			
Capacity	G.P.M.	2,080	1200
Total Head	Ft.	60	180
Speed	R.P.M.	1,750	1,750
Low Pressure Service Water Pump			
Capacity	G.P.M.		4,400
Total Head	Ft.		113
Speed	R.P.M.		1,150
Auxiliary L.P. Service Water Pump			
Capacity	G.P.M.		1,150
Total Head	Ft.		126
Speed	R.P.M.		1,750
Fire Pump Main		1 motor-driven and 1 gasoline engine driven.	motor-driven
Capacity	G.P.M.(US)	1,500	1,000
Total Head	Ft.	289	280
Speed	R.P.M.		3 500
Fire Pump Emergency			
Capacity	G.P.M.		Gasoline engine driven 1,000
Total Head	Ft.		350
Speed	R.P.M.		1.875
Station Air Compressor			
Cu.Ft./Min.		300	500
Pressure	P.s.i.g.	115	100
Speed	R.P.M.	310	285
Instrument Air Compressor			
Cu.Ft./Min.		150	200
Pressure	P.s.i.g.	100	100
Speed	R.P.M.	420	350
Ventilation			
(Boiler and Turbine Rooms)			
Supply Fans	No.	6	6
Standard Air	C.F.M.	282,000	334,000
Speed	R.P.M.	1 750	795/855
Crane			
Capacity (Tons)		150	150
Span		104′–6″	92′–6″
Total Auxiliary Power Kw. (at 100% load)		6,110	4,150

Combined with the feed-water heating is the process required for "make-up" water to cover unavoidable losses in the station equipment, such as, continuous blow-down from the steam generator, gland losses in the turbine and steam required for soot-blowers and other steam-using auxiliaries.

At the Richard L. Hearn Generating Station, four of the five extraction points are used for the present feed water heating system with provision made for later using the 5th connection. The flow of the feed water at this station is as follows:

The condensate from the hot well of the main condenser flows to the condensate pumps which force it first through the condenser section of the air ejector and then into an elevated direct contact heater which receives steam from the 34th stage of the turbine or the 5th extraction point.

The condensate or feed water then drops into the suction of the condensate booster pumps, which forces it through the 29th (4th extraction) closed heater, the evaporator condenser, the 22nd stage (3rd extraction) closed heater and then into the de-aerator, all in series. The condensate from the closed heaters is picked up by the drip pumps and pumped into the main stream of the feed water. Treated city water is pumped into the evaporator as required and is evaporated by steam from the 22nd stage (3rd extraction) the vapour being condensed by the feed water flow as mentioned above.

The de-aerator is vented to remove any air or non-condensable gases in the feed water, which removal is vital in high pressure steam stations to prevent corrosion. It also acts as a direct contact heater, the feed water enters as a spray and is heated by steam withdrawn from the 16th stage (2nd extraction) of the turbine. The de-aerator also acts as a storage or surge tank on the system and discharges into the suction of the boiler feed pump, which forces the water through the necessary level controls into the economizer section of the steam generator.

At the J. Clark Keith Generating Station, all five extraction points are used for progressively heating the feed water. The condensate pumps draw condensate from the condenser hot well and force it through the air ejector condenser and two closed low pressure heaters in series and then into the de-aerator. The low pressure heaters receive steam from the 4th and 5th extraction connections and the de-aerator from the 3rd extraction point.

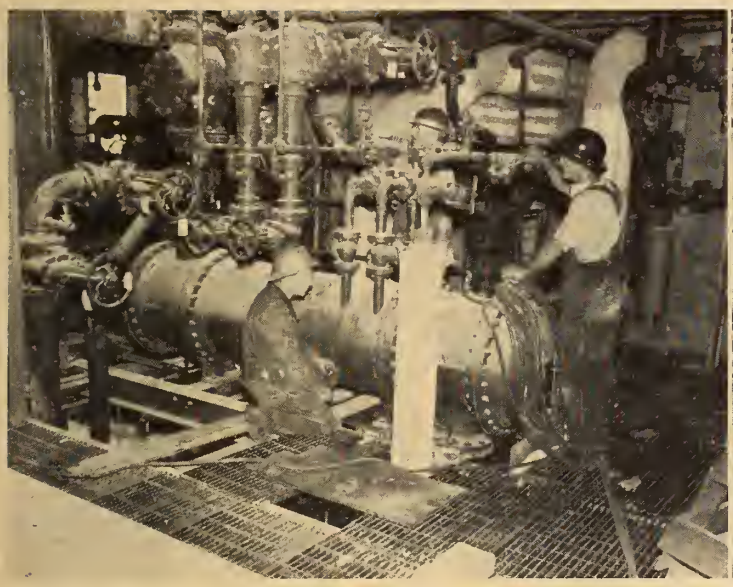


Fig. 32. View of air ejectors.

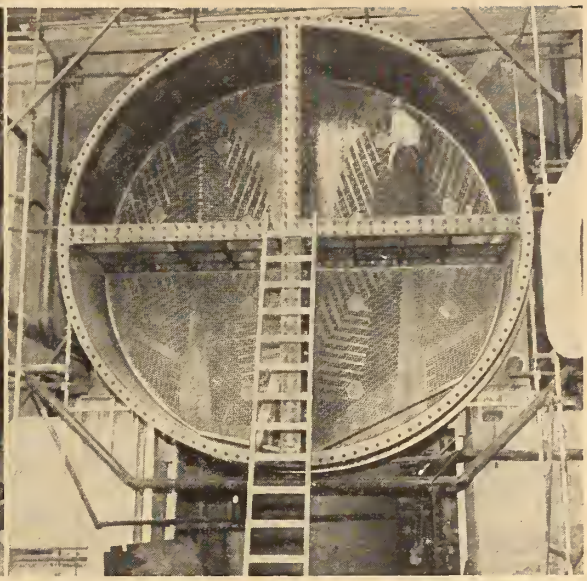


Fig. 33. View looking into condenser, showing tube sheet prior to installation of condenser tubes.

The evaporator receives steam from the 2nd extraction and discharges the vapour to the de-aerator.

The de-aerator discharges to the suction of the feed pumps, which force the feed water through two high pressure closed heaters in series, and then into the economizer section of the steam generator. The high pressure heaters receive steam from the 1st and 2nd extraction points. The drips from all heaters are returned to the main feed water flow by drip pumps.

Feed Water Control

A three-element air-operated feed water control is installed to maintain a constant drum level or one which varies with the steam generator rating.

The three elements which make up this control system are:

1. Steam flow from the steam generator
2. Feed water flow to the steam generator
3. Water level in the steam drum.

The primary function of the system is to maintain feed flow in proper proportion to steam flow, this being accomplished by a corrective air loading pressure being applied to the regulator valve whenever steam and feed flow get out of balance. A secondary corrective air loading pressure is also applied to the regulator when drum level varies from the desired position.

The measurement of steam flow from the steam generator is a much better measure of feed water requirements than a measurement of the steam drum level, which may be affected by shrinkage or swell in the drum.

AUXILIARIES

Station auxiliaries comprise service water and fire pumps; service and instrument air compressor; lubricating oil, insulating oil and fuel oil pumps; ventilating fans; vacuum cleaning equipment; water treating equipment; crane and hoists; elevators and control batteries with motor-generator.

OPERATION

Although recent abnormally rapid system expansion forced the use of large steam stations, because of insufficient hydraulic stations, the use of such steam stations for peak loading on relatively low annual use factors can be economical since the annual cost of "steam" power can then be very reasonable and transmission line "carrying charges" are not of significance when steam stations are located adjacent to areas of large demand.

The incremental annual system load growth for the past fifty years and the expected growth for the next seven years is shown by Figure 16 "Primary Peak Demand and Power Resources—Southern Ontario System". Also shown are the power resources for 1950 to 1957.

Since the system annual peak occurs about December 20th and the summer demand is normally much below the December peak, a load duration curve as given in Figure 17 can be of use in predicting the annual use factor for 100,000 kw. laminations at the peak of the curve.

Actual power costs from steam stations are not yet available, but estimated costs for use factors as obtained from the load duration curves can be obtained from the curve data as given in Figure 18.

It will be seen that although the total unit cost in mills per kwh. increases rapidly for the lower annual use factors, the annual cost in dollars per kw. year decreases with the lower use factors. It is therefore important to keep the "steam" stations on the lower annual use factors if the annual system power cost is to be kept down to a minimum when the power system is primarily "hydraulic". This can be done by operating the steam station on the daily peaks of the high days of the weeks in the months during which the system loading is higher than the "hydraulic" capacity available. √

NOTE

In addition to the material which appears in this issue, the following technical papers were scheduled for appearance in the Technical Section: "Concrete Aggregates", by S. L. Burns, M.E.I.C., and "Problems of Structure and Organization in Relation to Administration and Management", by Lyn Urwick.

Mechanical and other difficulties beyond our control have made it impossible to include them in this number, but they will appear at an early date.

Passenger Car Heating and Air Conditioning

by

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Montreal.

A paper presented before the Mechanical Section of the Montreal Branch of The Engineering Institute of Canada, on January 22, 1952.

Tracing the evolution of rail coaches from the antiquated and poorly serviced vehicle of forty years ago to its modern air conditioned successor, the author describes the five main systems of air conditioning in use for rail cars today. The railways switched from the ice-activated method first used in the "thirties" to the electro-mechanical method now in general service. Concurrently they changed from the vapour system of heating to the presently used zone system. The Canadian Pacific's pioneering with panel heating is recorded, and various thermostatic and other controls are discussed, as well as means employed for overcoming humidity.

During the past forty years the development in passenger cars has been such that, except for general contour and purpose, the car of today bears almost no resemblance to the car of 1910. Even among railroad men few, apart from car designers, realize what has been involved in the development of the modern railroad car.

The all-steel car was introduced in the first decade of the century and adopted as standard around 1910. The first Canadian steel car built at the Canadian Pacific Angus Shops in Montreal went into service in June, 1912. The delay was due to some hesitancy regarding the practicality of steel construction in our Winter climate, and to the problems of insulating and heating a steel car. Since 1914 all new cars have been of steel.

Prior to the advent of the steel car, few engineering problems were encountered in car work and, in the railway shops, engineering was practically restricted to locomotive work. The railway coach had evolved from the old stage-coach by a rather slow process. Apart from the addition of a few steel members, such as tie, hog or truss rods, and flitch members in some composite parts, was framed in about the same manner as a stage coach. The only drawings required usually were a floor plan and a cross section, and even with these the finished length of a car sometimes depended on the length of the wooden sills available. Even the trucks were framed of wood, with steel flitch plates reinforcing some of the members, such as the side sills and bolsters.

Old Fashioned Services

The heating media generally were hot water or live steam, but attempts were being made to develop an atmospheric, or vapour, system. Quite a number of cars still had stoves as their only heating equipment. The hot water usually was heated by a coal fired heater. However, the duplex heater, using steam from the locomotive through the inner pipe of a double coil, was being applied to all new cars. Prior to this a system using a commingler, in which steam was injected into the water, had been applied to a number of cars, but had not given great satisfaction and was too noisy in operation.

Pintsch gas was the accepted fuel for lighting, though many of the branch line cars still had kerosene lamps. Experiments had been made with acetylene gas, but these had been abandoned in favour of the safer and more reliable Pintsch. Some experimental applications of electric lighting had been made using 1½ kw, belt driven, generators.

The water supply generally was carried in overhead tanks and fed by gravity to the required outlets. The underneath car storage tanks using compressed air from the brake system were just coming into general acceptance. The lead plumbing was of the concealed type. Drinking water was carried in a tank which usually stood on the washbasin, and the water was cooled by having ice dumped into it.

Ventilation could only be obtained by opening the doors and windows, assisted by small sash located in the clerestory of the upper deck, and by small globe ventilators in the toilets. A few cars had been equipped with exhaust ventilators on the side deck in an effort to improve conditions.

Many of the "rule of thumb" methods of car designing used heretofore have proven costly and present economic conditions demand that sound engineering principles be formulated to guide the car designer. Car engineers are conscious of the need for improved research facilities. Railroad executives are realizing that they must endeavour to raise the technical level of car staffs, increasing the proportion of technical school graduates and engineers. The number of units involved, both freight and passenger, and the high cost of components, make it imperative that this be done.

Rules and Standards

There are some cardinal rules in car building which must be observed; all equipment must be built or applied so that it does not foul the clearance lines for tunnels and structures; weight must be kept at a minimum, and there must be no reduction in revenue producing space. Most important of all, the car must meet the A.A.R. specifications for strength and their interchange rules. The designer cannot lengthen the car to accommodate additional equipment, as cars now are at the maximum length possible with present clearance outlines and track curvatures. About the only space available is on the underframe or in the upper deck, above the ceiling.

Many of the design factors used in stationary installations are quite inadequate for railway car work. The railway car is a structure subjected to all the forces involving a building, except perhaps foundations, yet with the additional ones of shock, vibration and torsion. It has no orientation on which to base calculations concerning sun loads or prevailing winds; no municipal sewers of water mains to which its services can be connected; it must be completely self-sustaining.

Physical limitations often make it impossible to meet the generally accepted standards of good practice. Equipment must be compact, low in weight, easily accessible for inspection and servicing, and must not transmit any vibration or noise objectionable to passengers. Further, it must be sufficiently rugged to withstand the normal shocks and vibration to which it will be subjected in service. Consequently much of the equipment must be specially designed, adding to the cost and greatly restricting the sources of supply.

Over the years a set of standards, or perhaps more correctly, minimum requirements, have evolved. These are based more on experience than on the usual elements of design. For example, equipment suspended from the underframe, such as compressors and condensers are designed to withstand shocks in the nature of 10 g. longitudinally, 4 g. vertically and 6 g. transversely. The heating system usually is designed for a minimum outside temperature of −40 degrees F., for while considerably lower temperatures have been recorded on Canadian lines, these usually are localized and the areas quickly passed through without discomfort.

Air Conditioning

Air conditioning posed the first great problem, requiring the addition to the cars of relatively bulky equipment and the provision of power to operate it. Few new cars were being built during the depression years, and most air conditioning was applied to cars already in service. Generally the entire underframe had to be stripped and existing equipment relocated to provide the necessary space. In many cases the journals had to be increased to carry the greater load.

There was great diversity of opinion as to which type of system was the most suitable for railroad service considering all factors, such as investment, tare weight, maintenance facilities, etc. Five main types were offered, steam injector, electro-

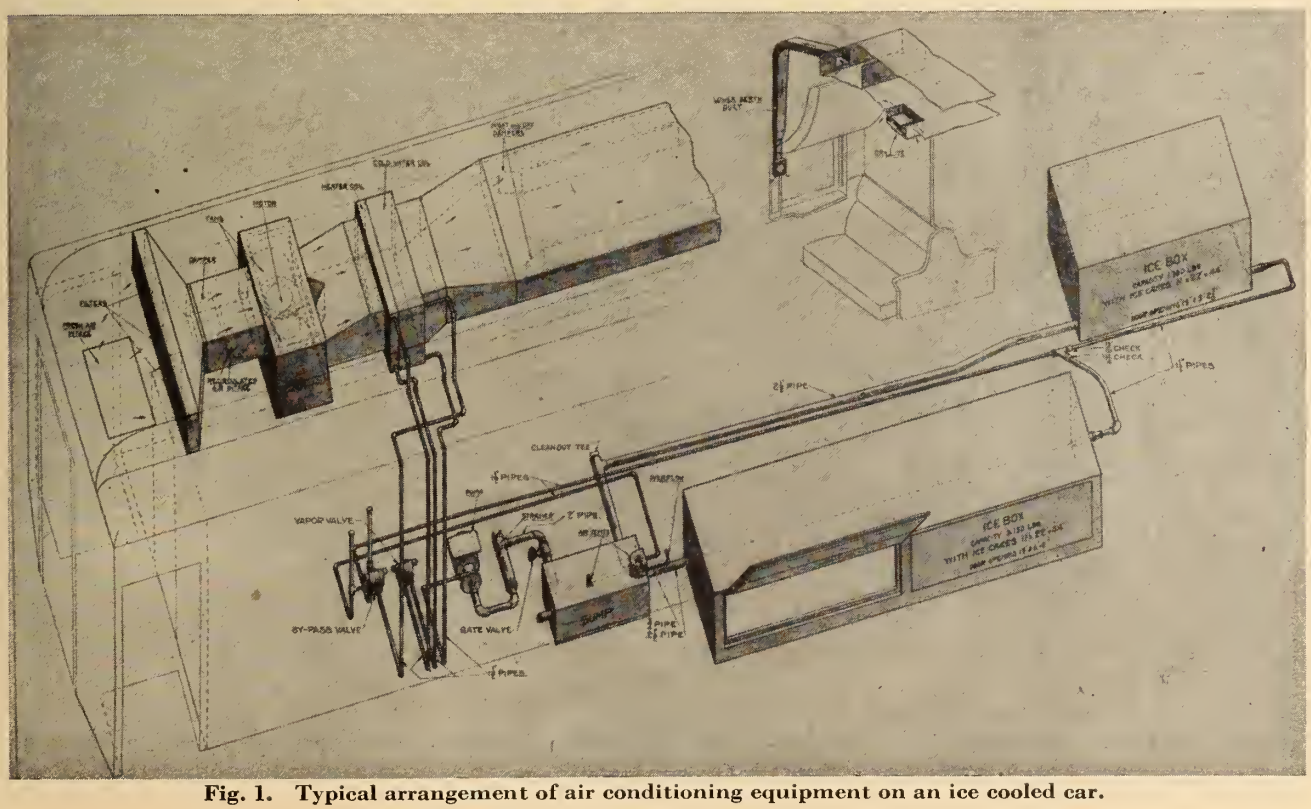

Fig. 1. Typical arrangement of air conditioning equipment on an ice cooled car.

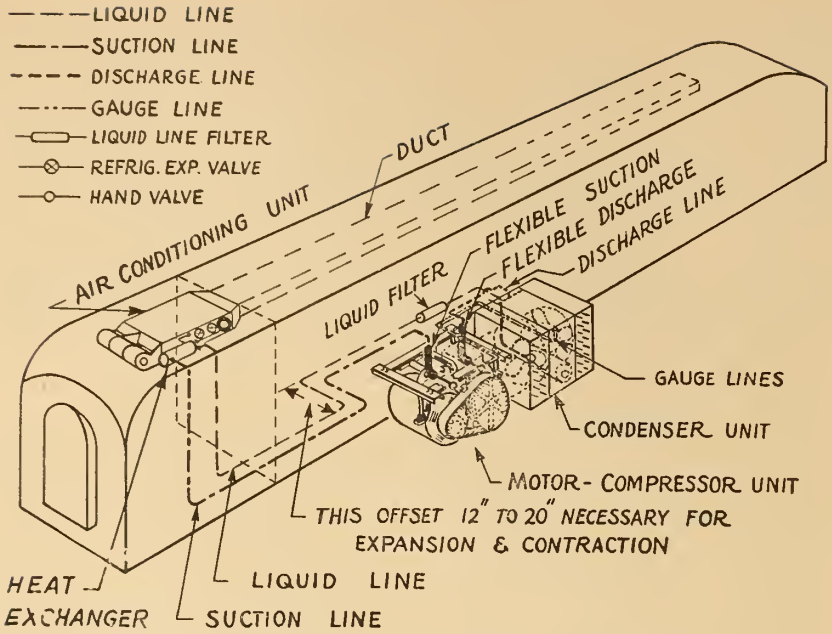

Fig. 2. Typical arrangement with mechanical cooling equipment.

mechanical, gas engine mechanical, axle-driven mechanical and ice activated. Because of climatic and economic conditions the Canadian railways decided to adopt the ice activated system. During 1936 the A.A.R. conducted a research program covering all phases of air conditioning, and their findings confirmed the decision.

Following the outbreak of war in 1939 conditions in the ice market changed. There was a sharp decrease in the natural ice harvest, without a corresponding increase in ice manufacturing. It became increasingly difficult to maintain satisfactory passenger car cooling. Priority in the use of available ice was given to the preservation of perishable foods. Casual labour became scarce, and loading costs rose rapidly. In 1948, following a survey of the factors involved, the decision was made that future air conditioning installations would be of the electro-mechanical type.

The critical control requirements; six-sided exposure; close confines of the space; speed, climatic and other variants to which a car is subjected, all combine to present the car engineer with some of the most difficult problems in the sphere of air conditioning and heating.

The cooling and ventilating of a passenger car requires that from 1,600 to 2,400 c.f.m. of air be circulated, of which from ¼ to ⅓ is fresh air. In the heating phase the volume of air circulated is automatically reduced 35 per cent, to avoid the sensation of draught which would result with the low relative humidities generally existing. The air is distributed through overhead ducts, after being filtered and cooled or heated to the desired temperature, and delivered to the passenger space through aspirating or diffusing outlets. The velocity and temperature at the outlets must be controlled carefully to avoid objectionable draughts.

In the early days of railway air conditioning the cooling aspect was overstressed, but it quickly became evident that other factors were equally important from the passenger's point of view. Filtered fresh air was provided, windows and other possible leak points were sealed, and the old gravity ventilators were removed, with resulting cleaner travelling conditions. This impressed many to a greater degree than did the cooling.

The refrigeration required to cool a car may vary from 6 to 10 tons, depending on the type of car, passenger capacity, or climatic conditions through which it is to operate. Passenger car air conditioning differs little from domestic or commercial applications, except in the location and mounting of the equipment.

Ice Cooled Cars

Figure No. 1 shows a typical arrangement of the air conditioning equipment on an ice cooled car. The ice is carried in bunkers suspended from the underframe. Water circulating around the ice is chilled and pumped to the coil in the evaporator unit, usually located in the roof. Air passing over the coil is cooled and circulated throughout the car.

When the desired car temperature is reached a by-pass valve operates, cutting the ice boxes out of the water circuit so that further cooling is prevented without stopping the pump. Should the car temperature fall below 71 degrees the pump is stopped, and no further cooling is possible. The bunkers are designed to take standard blocks of manufactured ice 11" x 22" x 33" or 44", and have a capacity of from 3,700 to 4,500 lbs. of ice. This is sufficient, under heavy heat loads, to maintain comfortable conditions over a run of ten hours.

Mechanical Cooling

Figure No. 2 shows a typical mechanical cooling arrangement. The compressor and condenser units are located under the car. The evaporator is similar to that of the ice cooled car in location and general arrangement. Freon-12 is used as the refrigerant. Manufacturers generally supply one type of compressor to cover the range from 6-10 tons, varying the speed to suit the requirements. Three types of condensers are available, the dry for loads of 6 and 7 tons; the spray type of wet condenser for 8 and 9 ton loads, and the full-flooded type for 9 and 10 ton loads. Condenser selection may be governed by considerations other than the interior load, since territorial factors such as dust, consistently high outside temperatures, etc., adversely affect condenser efficiency.

The water for the wet types is taken from the car water system and its use must be conserved, so an automatic valve, which opens only when the refrigerant head pressure is above 150 lbs. is used. In other words, water is used only when air cooling at the condenser cannot maintain satisfactory operation. Present types of cars on Canadian roads have not required the use of wet condensers.

In general the compressors are 4-cylinder, belt driven, reciprocal type, but these are becoming obsolete. New direct driven, high speed compressors, suitable for car use, have been developed. Because of the prevalence of direct current it has not been possible to obtain the advantages of the sealed type of compressor. With the introduction of the undercar, deisel driven, alternating current generators it is anticipated that this type of com-

pressor will become general on all a-c cars.

The gas engine mechanical type is similar to the electro-mechanical except that the compressor is driven by a direct-coupled propane gas engine.

Steam Ejector Cooling

Figure No. 3 shows the steam ejector type of cooling used principally by roads operating through dry territory with an extended cooling season. Steam taken from the train line at not less than 45 p.s.i. passing through a venturi mounted on a water tank, or evaporator, induces a vacuum in the tank. The steam leaves the nozzle at a pressure considerably below atmosphere and at high velocity, entraining water vapour from the evaporator.

As the mixture of steam and vapour passes to the throat of the diffuser it is slightly recompressed to the pressure existing in the condenser, to which it is passed. The condenser has a dual function: (1) to maintain the ejector outlet pressure at a sufficiently low value to permit the ejector to operate (from 1½″ to 2″ of Mercury) and (2) to conserve water by condensing the mixture, making the resulting water available for use in the equipment.

Under service conditions the evaporator operates at .284″ mercury, so that the water temperature is 50 degrees F. The chilled water is circulated through the cooling coils as in ice activated systems and returned to the evaporator through the spray nozzles. Rapid evaporation takes place from the large surface of the spray, the vapour being withdrawn by the steam ejector, while the remaining water drops to the bottom of the evaporator to repeat the cycle.

A continuous supply of water is necessary to maintain the required volume in the cold water system, and this is taken from the condenser. Any excess resulting from the condensation of the steam is diverted to the condenser spray system. A vacuum check valve is applied in the line connecting the two systems so as to prevent loss of vacuum when the spray pump is stopped.

The first railway car to be air conditioned in Canada, the Canadian Pacific Sleeper "Sturgeon Falls" was equipped with this system, but it was removed after a few years operation because of the expense involved in maintaining the required supply of steam in stations to precool the car before departure. A fourth system, the Pullman axle driven mechanical system now is obsolete though there are still some cars in service so equipped.

Car Heating

Canadian climatic conditions make the matter of passenger car heating one of paramount importance. It is general on Canadian roads to use −40 degrees F. as a minimum design temperature, both for freight and passenger car work. Although considerably lower temperatures have been recorded, these usually are of short duration and localized in extent, and so are quickly passed through without damage or discomfort.

Steam, at pressures up to 185 lbs. is taken from the locomotive; from the turret on a steam locomotive boiler, or from a steam generator on a diesel or electric locomotive, and carried the length of the train through a train line underneath the cars. End valves and flexible metallic conduits are provided at the ends of the tender and of each car to make the necessary connections. The train line on most cars is of 2″

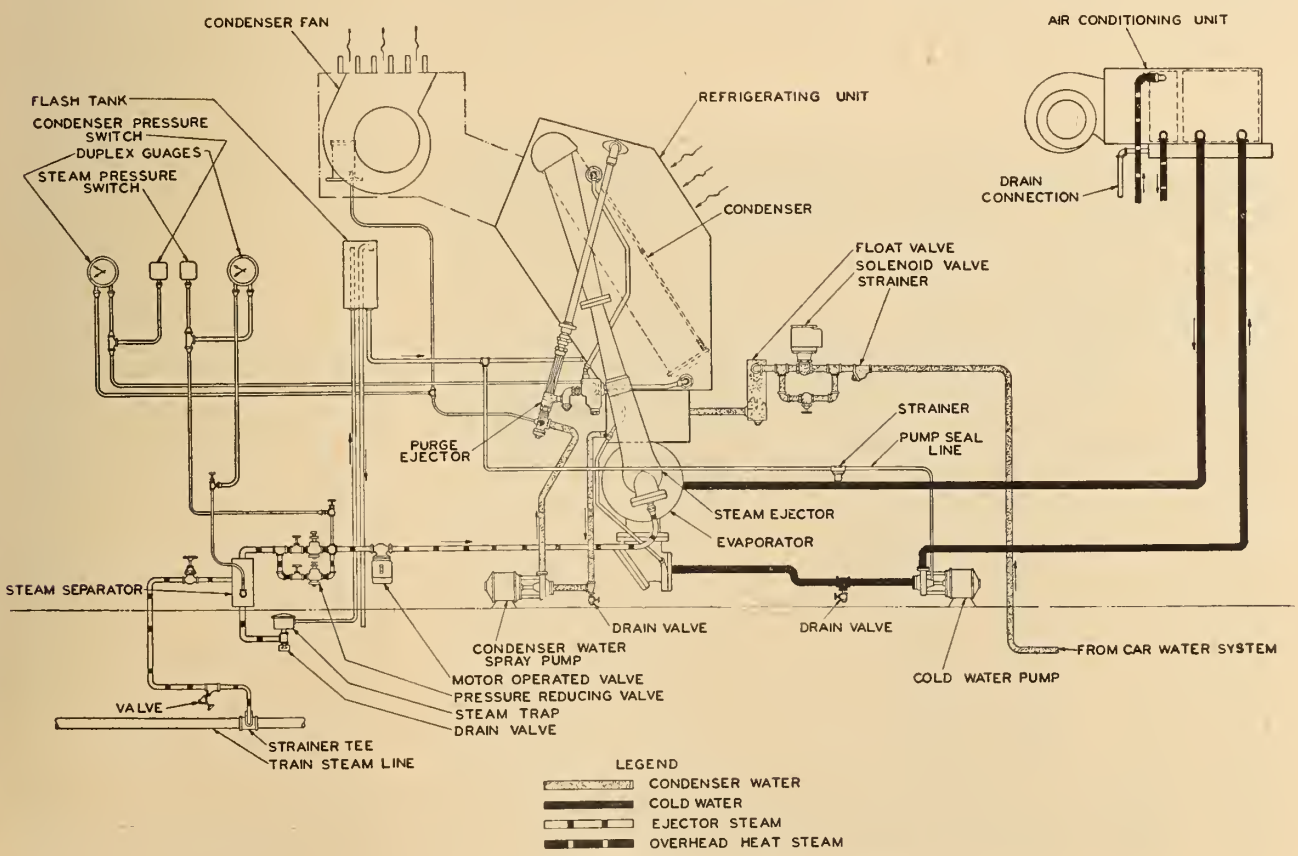

Fig. 3. Arrangement of steam ejector type cooling.

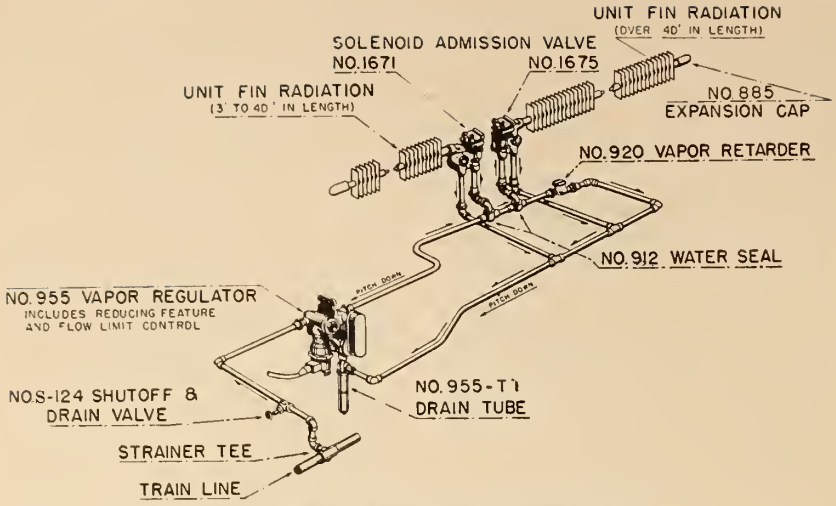

Fig. 4. Typical arrangement of "zone" system.

pipe, but with modern engines and longer trains this is no longer adequate. Train lines progressively are being changed to 2½″ throughout, starting with the head end cars, such as baggage and mail cars.

A heating capacity of 180,000 to 200,000 B.t.u.'s an hour is adequate for an air conditioned car. Of this approximately 85,000 B.t.u.'s are provided by the overhead heat coil, and the remainder by the floor radiation. Due to heat losses from the exposed piping, etc., on the underframe, and at the connectors between the cars, it is necessary to make provision for a supply of upwards of 300 lbs. of steam per car per hour, some even setting the requirements as high as 450 lbs. per hour.

So far as I am aware, no accurate observations have been made of actual steam consumption over an extended period, and under severe conditions, though many attempts have been made. Available information would indicate that, with an outside temperature of −20 degrees, a 14-car train, and at an average speed of 45 m.p.h. a steam consumption of slightly over 300 lbs. per car per hour can be expected. Over short periods, such as when charging a train line, a demand of well over 400 lbs. per car per hour has been recorded.

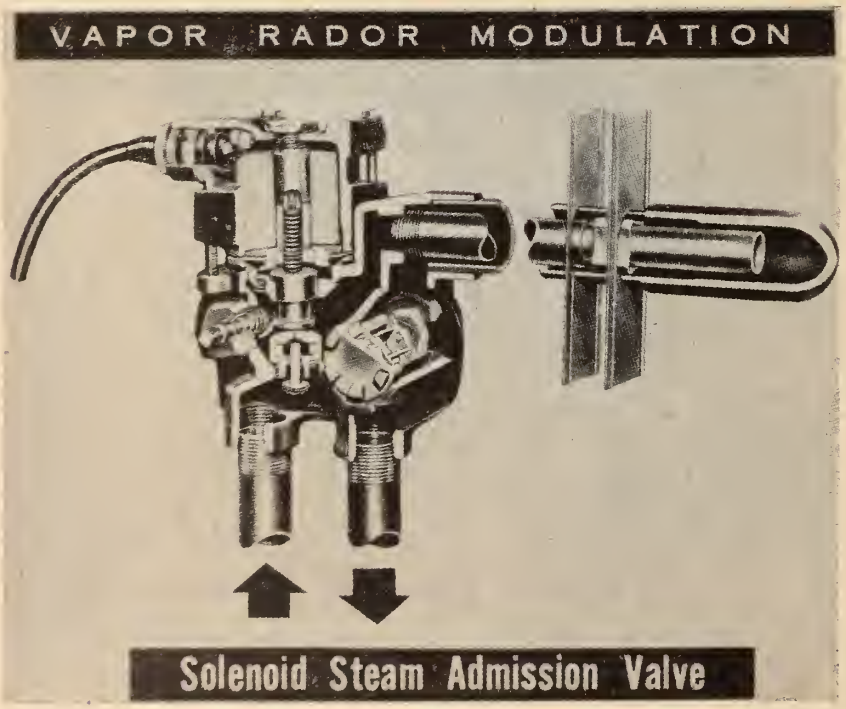

Fig. 5. Solenoid Steam Admission Valve.

Vapour System

Up to 1940 the standard for car heating was a nominal vapour system, in that the return side was open to atmosphere, and many cars still are equipped with this system. Steam from the train line is reduced to 40 p.s.i. and passed through a regulator to the car interior piping. The steam admission valves are connected in series so that, if one of the valves is open, steam and condensate has to pass through it, and the radiation connected to it, before the next valve is supplied, and so on back to the regulator where the condensate is evacuated to the track.

Pressures of up to 25 lbs. often are required to force the condensate through the system and, should pressures be low, as in the case of rear cars in long trains in severe weather, proper circulation cannot be secured and the space supplied by the last valves in a series is not properly heated.

The regulators and traps under the car are adjusted so that there is a small, but constant, blow of steam from each to ensure that there is an adequate supply of steam to the car radiation at all times. Maintenance men usually "play safe" so that there is a considerable steam wastage, as well as a definite safety hazard in cold weather when the visibility down the side of a train may be reduced to a few car lengths. Much has been done to eliminate this wastage by the use of very sensitive, non-adjustable diaphragms.

A new system, loosely called a "zone" system and designed around the bellows diaphragm, was introduced about 1940 (Fig. 4), and quickly became standard for practically all new and remodelled equipment. In this the regulator combines a reducing valve, supply valve, and safe control valve. Steam enters the regulator at train line pressure and is reduced to about 50 p.s.i., passing through the supply valve to a feed loop. It is retained in the loop by a retarder fitting, which may be of the bellows or orifice type, while the condensate passes and is discharged to the track at the regulator.

When the desired loop pressure is reached (3, 8 or 12 lbs. depending on the length and type of radiation) the safe control valve lifts, admitting steam to the diaphragm chamber,

expanding the diaphragm and closing the supply valve. A solenoid in the safe control valve provides electrical operation, locking out steam automatically when cooling is in operation and providing economical control when the car is in the yards.

The steam admission solenoid valves (Fig. 5) which supply the car radiation are energized to close, so that, should there be an electrical failure, the return spring opens the valve and protects the car from freezing. The valves supplied by any one loop are fed simultaneously, being in parallel, giving rapid and even heating in response to any demand. Retarders in the return line retain steam in the radiation, while permitting the ejection of condensate.

Restrictions on the underframe, particularly over the trucks, make it practically impossible to locate floor heat valves at the ends of the cars where heat is most required. Coils therefore are usually fed from the centre of the car towards the ends. When thermostatic control was introduced it was found difficult to obtain adequate heating at the ends of the cars, the direction of the heat flow causing premature thermostatic action. This lead to the development of unit fin pipe, now generally used for car radiation. This consists of two concentric tubes, the inner being the feed and the outer, which has extended finned surface, being the return. Steam is delivered quickly to the end of the coil away from the valve, and the coil heats progressively back towards the valve. In this way the colder part of the car is heated before the thermostat is satisfied, and more even heating throughout the space is obtained.

Panel Heating

The shape, low ceiling height, large glass area, and similar factors, as well as the fact that passengers sit close to the windows, make it extremely difficult to secure comfortable conditions. Recently most roads have gone to a form of panel heating, in which warm air from the side wall radiation rises behind the wainscoting and through a slotted outlet at the window sill.

The rising film of air over the glass surface provides an effective barrier between the passenger and the cold glass, while the radiant heat from the wainscoting gives a sensation of comfort. The wainscoting should be kept below 90 degrees to provide satisfactory conditions. The Canadian Pacific Railway made some of the earliest experiments along this line, and was the first road to make any extensive applications. Passenger reaction has been favourable, and this design now is considered as standard for all new cars.

It has been the general practice on Canadian roads to consider the floor heat as the basic system. The overhead air is admitted to the passenger space at a temperature slightly lower than that of the desired overall heat level, in order to avoid stratification. In some cases the overhead heat alone is used in mild weather, no floor heat being available until a pre-determined outside temperature is reached. The present trend is towards a closer co-ordination of both systems, using the overhead heat thermostat as a master control.

Some new factors have recently been introduced into the car heating picture. One of these is the undercar diesel generating plant, with an output of 25-30 kw., to supply power for air conditioning, lighting, refrigeration, etc. When cooling is not required approximately 15 kw. are available for heating. Also there is considerable potential heating capacity in the engine coolant liquid and exhaust gases. Some experimental work has been done towards the utilization of this heat, but none of the applications made to date seem to be fully satisfactory, due largely to the complication of controls, so the practicality of the conservation of this waste heat still is an open question.

Another development is a small oil fired hot water heater of about 150,000-180,000 B.t.u.'s per hour, for single car heating, but this still is in the experimental stage. In any event its use probably will be limited to unit or suburban cars. Steam from a stationary plant still remains the only practical medium for layover heating, so, if either of the above were adopted some form of steam heating would also have to be provided to protect the cars while in the yards.

Controls

General control principles are well defined, though each type of car requires careful study to secure optimum results. Usually it is possible to limit variations in temperature levels to 1 degree throughout the car. Theoretically the best control is a fully automatic one, in which the comfort equipment is started by turning a single switch, the thermostats selecting the operating phase, either cooling, ventilation or heating, and automatically changing from one phase to another as conditions change. The controls are set up to provide optimum conditions, and passengers do not suffer from human failures, or from the whims of the crew, as sometimes is the case with other types of controls.

Unlike an industrial installation where operation or maintenance work is handled by a fixed personnel who become familiar with it, a car is handled by differing crews and maintenance staffs, who also have numerous types of installations to look after from day to day. Because of this it has been found that the performance obtained from fully automatic controls has not come up to anticipations, though the controls themselves are not unduly complicated. A compromise has been made in some more recent installations with a view to simplification. The operating phase is selected by the train crew, though the temperature levels are controlled automatically within the phase.

In general the mercury type of thermostat is used. To be acceptable for car work a thermostat must respond within close limits, particularly when used in automatic control circuits where operation within $\pm$ 0.3 degrees is considered necessary if hunting between the operating phases positively is to be avoided. This rules out bimetallic thermostats for most purposes, although some manufacturers now claim to be able to meet these conditions.

The thermostat generally used is one developed especially for passenger car work, and which has a secondary mercury bulb above the usual one. This bulb has a 600 ohm resistance heater winding wrapped around it, insulated from the ambient temperatures. Controlled amounts of current may be imposed on the heater winding to give a set-down below the fixed temperature rating. Thus a 76-degree thermostat may be used to control at any lower temperature within the range of the set-down, usually 29 degrees or so, eliminating the need for tubes of different ratings. A potentiometer in series with the heater provides variable control of the thermostat.

Modulation

Another adaption of this thermostat makes possible anticipatory modulation of the heating, to ensure that the temperature will level off at the desired point, avoiding overruns. A resistance is placed in parallel with the fixed resistance used for set-down, and, by cycling this resistance by means of the relay operated by the thermostat, additional heat is imposed on the secondary bulb when the mercury is below the contact point.

When the mercury rises and makes contact at the control point the relay cuts out the cycling resistor. Thus the thermostat is then affected only by the ambient temperature and the set-down heat. Proper balancing of the cycling resistance with the heating requirements tapers off the steam input, so that the control point is reached without any excess. Similar thermostat-relay combinations control the functioning of all other comfort equipment and provide interlocks between the cooling and heating phases.

Recently some applications have been made involving a resistance type of thermostat applied in one leg of a Wheatstone bridge circuit. Any unbalance in the bridge resulting from temperature changes is amplified electronically, putting corrective measures into action. This is an interesting development and is being followed closely, but because of anticipated maintenance difficulties it has not found ready acceptance.

Temperatures maintained in passenger cars vary considerably on different roads, depending largely on the climatic conditions in the territory served. Canadian car temperatures generally are lower than those in the U.S., particularly in the Southern States where 76 degrees is considered satisfactory. Early controls were of the stepped type, in which the train crew selected the temperature they considered most suitable.

Later, correlative cooling controls became popular, the inside temperature varying in a set ratio with the outside. Usually the inside temperature was raised ½ degree above 71 degrees for every degree the outside temperature went above 80 degrees. This later was discarded when research showed that "temperature shock" could be discounted where reasonably healthy people were concerned.

The next development was fully automatic controls, intended to eliminate the human element in temperature selection for any individual car. With these, the minimum cooling temperature is set at 73 degrees, and the maximum heating at 72 degrees in order to avoid "hunting" between the two phases in mild weather. A positive interlock is provided to lock out cooling when the outside temperature is below 55 degrees and heating when it is above 70 degrees.

Humidity

Perhaps the greatest problem in passenger car air conditioning is that of humidity, and it is one about which little has been done. With outside temperatures of around 60 to 70 degrees and high relative humidity, it is possible to get a considerable build-up of latent heat in a car without a corresponding sensible heat increase. As the controls are responsive only to sensible heat the cooling is not cut in, and a degree of passenger discomfort may ensue.

In industrial applications a similar condition would be overcome by the use of reheating, continuing the cooling system in operation by means of a humidistat in series or parallel with the dry bulb thermostat, as long as the dew point is above the desired maximum. In this way air passing through the unit is relieved of excess moisture, and then passed over a heating coil to maintain the desired dry bulb condition. A number of cars have been equipped for reheat, but results have not been satisfactory because of the lack of a reliable humidistat that will give consistent control and stand up under railway operating conditions.

During the heating season the reverse is the case, and a satisfactory minimum relative humidity cannot be maintained most of the time. Additional moisture cannot be introduced into the car without objectionable fogging or frosting of the window glass, or the formation of condensate on walls and other surfaces.

Mechanical cooling requires a 12-hp. motor to run the compressor, and two 1-hp. motors to run the condenser and evaporator fans. Because of the relatively heavy load a stepped starter is used in conjunction with a time delay device. The evaporator fans must be in operation or the compressor cannot be started. In the event of failure of the power supply, a low voltage cut out is provided to stop the compressor at a point which ensures that sufficient reserve is left in the battery to provide adequate lighting and other facilities until the terminal is reached.

When full cooling is required the compressor is operated at full speed and the entire evaporator coil is in use. When the desired temperature is reached the cooling capacity is reduced, either by cutting down the speed of the compressor, or by unloading one or more cylinders. At the same time a solenoid valve in the refrigerant line is closed, shutting off the supply of freon to one-half of the evaporator coil. This ensures that a satisfactory dew point of the leaving air is maintained. Should the car temperature drop approximately 2 degrees below the control point the compressor is stopped, and further cooling prevented.

Power Supply

Little has been said here regarding the power supply, or kindred subjects such as food and beverage refrigeration. It is generally accepted that ice refrigeration is a thing of the past, and that all future installations will be of the mechanical type.

Electric loads on passenger cars have increased rapidly. The practical limit of axle driven generators has been reached, while the connected loads will continue to increase, so other means have to be developed. The most promising at present is a diesel driven alternator mounted on the underframe of the car and producing from 25-33 kw. One advantage of such units is that it makes possible the use of alternating current, getting away from the equipment supply problems imposed by the use of 32 volt or 64 volt direct current.

Economic statistics developed on experimental installations indicate that power is generated at about 1/9th the cost of d-c axle power. In many cases the cost is so low that it does not pay to plug a car in on the stationary power lines for standby service.

Many problems face the car engineer in the heating and air conditioning fields. Installations made 20 years hence will be as far advanced over those of to-day as to-day's are over those of 20 years ago. Improved reliability and greater simplification are pressing needs, and much remains to be done in the way of conserving steam by the reduction of undercar heat losses. Improved air filtration, either by electrostatic filters or similar means, would reduce car cleaning costs, if it can be developed.

Odour control by less expensive means than those presently available is another aim. The necessity or otherwise of providing means for controlling air-borne bacteria has not been established, though some roads have applied bactericidal lamps as an advertising feature. Considerable investigation has been conducted into these matters, and many others, and should satisfactory answers be obtained the railroads will not be slow to adopt them.

Glued Laminated Timber

by

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Exploitation of the world's resources has taken many directions. Not the least important of these has been the comparatively recent discovery that the size and value of timber can be enhanced through welding of layers of wood by glue into solid units. There can be produced a timber unit larger and stronger than to be found in the forests of any land.

German and Swiss engineers were the first to utilize glued laminated wood construction. The news of its many advantages soon spread throughout Europe and to the North American continent where, with the relative abundance of lumber, this new structural material was further developed and used extensively.

It must be recognized that this is not a substitute, inferior material. "Glulam", as it is known to the trade, has replaced structural steel in considerable degree, even when steel is in good supply. Moreover, it is not merely a substitute for big timber sticks that might no longer be available in a given market. It has won for itself a permanent place in the field of construction because, when properly made, glued laminated timber is a quality product.

When used for members such as columns, beams, girders and truss chords, these laminated pieces can be considered as substitutes for solid members. More usual and effective uses are as curved rafters, truss chords and arches of various shapes. In Canada and the United States one of the greatest demands for glued laminated timber has been for arch rafters, and arches have been used for rinks, gymnasia, auditoria, churches and bridges. Bowstring trusses and tied rafters have also been widely used.

Because of the dimensions of the laminations it is possible to dry the material in much less time than would be required for large size structural timbers. This is an important economic factor.

This is an abstract of a much longer paper entitled "Research on the Structural Use of Glued Laminated Timber", presented at the Building Research Congress in 1951. Because of space limitations, many of the technical data of the original paper have been omitted.

Many advantages are offered by glued laminated timber construction. While this material is of high quality and more readily obtainable than large solid structural timbers, it must be realized that it is expensive and that its field of usefulness is therefore restricted. It should and will be used because of its superior effectiveness and efficiency, as it offers sizes and shapes which are not obtainable in sawn timber.

It should be noted that in cases where structural designs using glued laminated timber were selected in preference to other designs the cost factor was not overlooked.

Species

Most generally used species for glued laminated members for construction are Douglas fir and southern yellow pine because of their availability and superior strength and suitability for gluing. White or eastern spruce has also been used, giving a product with lower strength than the two mentioned. Although they have not been used to any extent yet, there is no doubt that red pine, pine, white hemlock and cedar would be suitable material. Selection would depend upon strength, availability and cost.

Cost of a member includes the cost of lumber; drying and surfacing of laminations; glue; application of glue; assembly of laminations; pressing; curing, sometimes at elevated temperatures; removal of clamps and handling of finished product. Because the cost of lumber is only a fraction of the cost of the finished member, the saving in cost by using lower strength species will not justify their selection in most instances. There are cases, however, when factors other than cost, usually availability, dictate the use of such material.

Glues

In all lumber, the material is presumed to have defects which reduce its strength to some fraction of the strength of clear material, the fraction depending upon the magnitude of the defects. Presuming a defect factor of 25 per cent, the residual strength factor would be 0.75, which is what is classified by Canadian Standards Association (C.S.A.) as "select structural" grade.

Any definition of satisfactory gluing is arbitrary. As a requirement for satisfactory gluing the writer suggests that glued joints shall withstand a shearing stress not less than 90 per cent of the shear strength, parallel to the grain, of clear material of the species used

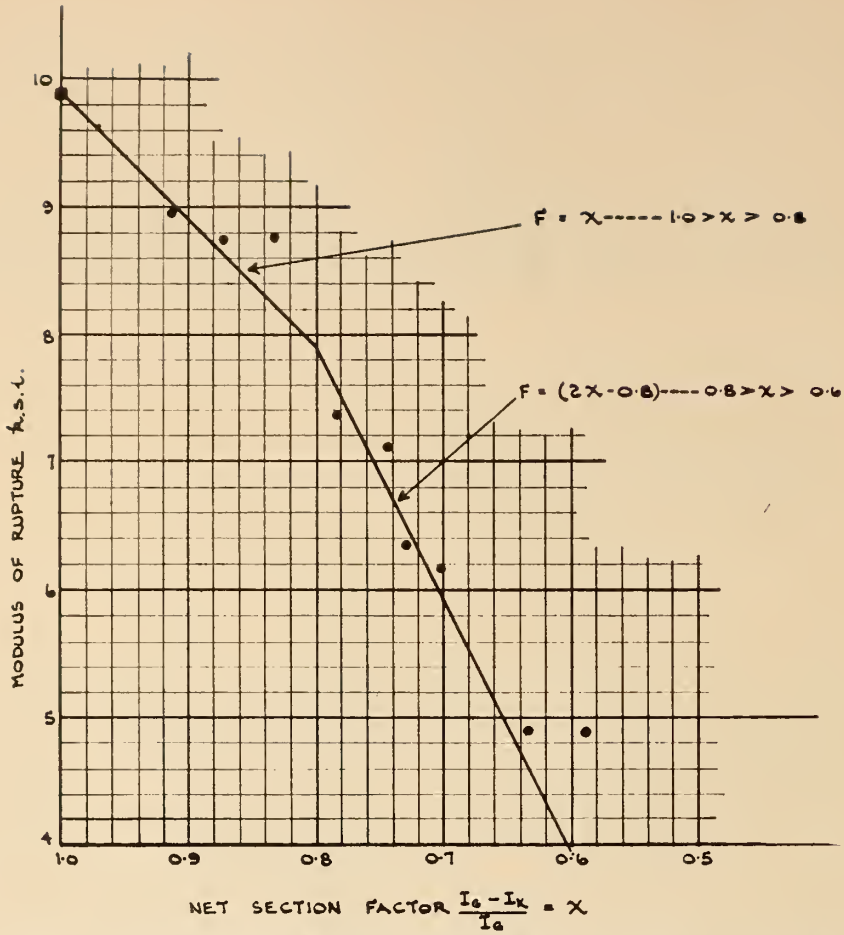

Fig. 1. Effect of defects on flexural strength of glued laminated beams. Each point represents the average of ten beams tested except for beams having x = 1.0 where average of 85 beams is plotted. I_g = gross moment of inertia of cross section; I_k = moment of inertia of the parts of the critical cross section occupied by knots; F = residual strength factor.

and shall maintain this strength throughout the life of the member.

Strength differences of glues are not a factor in their selection except insofar as the required minimum must be provided. The important factors in glue selection are cost; storage life of the glue; pot life; assembly time; pressure required on gluing surfaces; species and moisture content of laminations for which the glue is suitable; time and temperature requirements for curing; durability; resistance to decay, weathering and attack by organisms; damaging or weakening effect on wood fibres; difficulty of surfacing laminated member; reaction to wood preservatives.

One of the most significant characteristics of a glue is the temperature range for setting and curing. Glues are classified according to curing temperatures as follows (1)

Classification	Required temperatures for satisfactory curing within practical time limits
(a) Hot-setting.	Require higher temperatures than those commonly attained in heated chambers, for which the maximum is about 210° F.
(b) Intermediate-temperature-setting.	Require heating in excess of normal room temperatures (about 65° to 80° F.) but do not require temperatures above 210° F., the maximum that can ordinarily be attained in heated chambers.
(c) Room-temperature-setting.	Requires no heating above normal room temperatures (about 65° to 80° F.), but do not cure satisfactorily at lower temperatures.
(d) Cold-setting.	Set or cure below normal workroom temperatures (minimum about 65° F.), and some may set satisfactorily at temperatures as low as 32° F.

Since most glued laminated members which have been produced in North America to date have been for interior use, not subjected to severe moisture conditions, casein glue has been most generally used. Assembly line production methods in certain laminating shops have established the fact that resorcinol-formaldehyde-resin glue is particularly suitable because of the accelerated set which is obtained by the use of radio-frequency heating, particularly when high-quality, weather-proof bond is desired.

A thorough description of the properties and use characteristics of various types of glues is included in Reference (1).

Manufacturing Processes

Significant features of the manufacturing process are:

- Preparation of lumber
- Mixing and spreading of glue
- Assembly and Application of pressure
- Curing of glue in assemblies
- Storage of finished product
- Use of preservatives.

Preparation of Lumber

Species to be used will be selected on the basis of availability, strength and cost.

Moisture content for gluing will be established by the requirements of the glue and the moisture content of the member during its service life. In order to minimize stresses induced by unequal shrinkage or swelling of the laminations it is desirable to have uniformity of moisture content throughout the member as well as throughout each lamination. Satisfactory results are obtained with variations in moisture content of as much as five per cent between different points at a section of a member. Air drying or kiln drying may be used to bring the material to the required moisture content.

Planed surfaces are most satisfactory for gluing. Laminations must be of uniform thickness and when edge joints or end joints are pre-glued it is usually necessary to resurface the laminations.

Gluing Procedures

Because of the variety glues and the large number of brands available in any particular type it is not possible to give instructions for mixing and handling. Manufacturers supply specific instructions for all gluing products and for best results these should be followed.

Much valuable information concerning assembly techniques and other aspects of manufacturing is contained in Reference (1).

Preservative Treatment

For usual service, there is no economic advantage in preservative treatment. When exposure is such that preservative treatment of the wood is desirable this may be done by treatment of the glued laminated member, or by gluing together laminations which have been treated. In most cases the latter is preferred. Tests have indicated that certain types of glues, particularly those

which produce weatherproof bonds, perform satisfactorily with laminations treated with oil-base preservatives.

For any particular problem it is necessary to obtain specific information regarding the preservative treatment (3) and glue to be used.

Research Projects

Much investigation has been done in the Forest Products Laboratories at Ottawa and Madison and by commercial laminators concerning glue and the gluing of wood. Some of the tests which are of special interest in connection with the use of glued laminated timber in the construction field, are covered in References (4), (5), (6), (7) and (8).

A few of the conclusions arrived at are:

1. Strength of a flexural member is indicated by a "net section factor", based on the moment of inertia of the portions of the critical section occupied by defects. Fig. 1 and Table 3 illustrate this point.
2. When glueing pressure is obtained by the use of nails only, nails should not be shorter than two and one-half times the thickness of a lamination. The nailing pattern should be such as will hold the laminations in close contact until the glue is set. See Fig. 2.
3. Laminations may be end joined to develop a high fraction of their strength, depending upon the type of joint used. For plain scarf joints the following efficiencies are suggested:

Slope	1:12	1:10	1:8	1:5
Efficiency	90%	85%	80%	65%

4. Laminations may be bent without steaming to form curved members with R/t as low as 100, where R = radius of curvature and t = thickness of lamination. End scarf joints for laminations to be bent should have a flat slope.

The results of these tests are also summarized in Tables 1 to 8.

Permissible Design Stresses

In any structural member the permissible stress is established from a consideration of the probable strength of the material and a factor of safety. While the factor of safety is arbitrary, scientific data and analyses make possible a prediction of the probable strength.

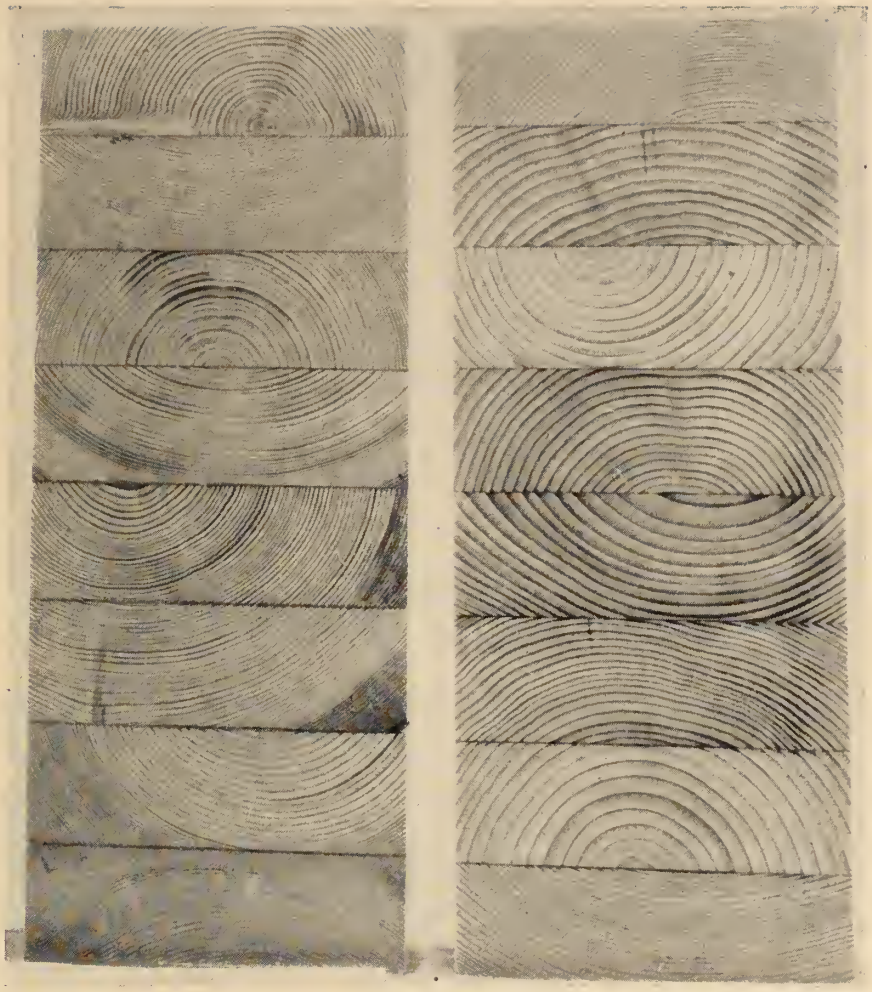

Fig. 2. Cross sections of beams using 1¾-in. by 5½-in. spruce laminations. Left: casein glue, pressure obtained by 4½-in. nails. Right: urea-formaldehyde glue, pressured of 150 p.s.i. obtained in screw press. Note: litte difference in thickness of glue line is apparent.—*Photo courtesy F.P.L., Ottawa, Ontario.*

Presuming proper joints, a glued laminated timber member is basically a timber member and the determination of probable strength is by essentially the same process as for any other timber member.

One of the commonly used methods (9) of determining permissible stresses is to divide the average strength of specimens tested by a gross factor, K, which is the resultant of several components. Expressed algebraically $K = a \times b \times c \times d$ where:

- a = effect of variability in strengths of different specimens
- b = long-time loading effect
- c = net factor of safety
- d = reciprocal of residual strength factor.

Study of results of tests of small clear specimens, tested green, suggests a value of 1.33 for a to allow for the variation to be expected between a low-strength specimen and the average. Long-time loading experiments have established a value of 1.78 for b. An arbitrary value of 1.67 has been used in many specifications for c. The residual strength factor depends upon the grade: for "select structural" Douglas fir, according to C.S.A. specifications it is 0.75. For this grade, d would be the reciprocal of 0.75, namely 1.33. Since tests at the Forest Products Laboratory, Ottawa, Ontario, have established a value of 8,100 p.s.i. for the average modulus of rupture, tested green, of Douglas fir, coast region, the permissible design stress for "select structural" grade of this species calculated according to the previously outlined method, would be

$$\frac{8{,}100}{1.33 \times 1.78 \times 1.67 \times 1.33} = 1{,}530 \text{ p.s.i.}$$

A value of 1,600 p.s.i. is specified by the C.S.A. specifications. Whereas

TABLE 1.—Strength characteristics of glued laminated beams* which failed in flexure, showing the effect of varying the size and number of laminations

Number of laminations	8	11	17
Number of beams	28	26	31
Modulus of rupture (p.s.i.)			
average	9,745	9,990	9,985
maximum	10,930	11,440	10,960
minimum	8,665	8,595	8,955
Stress at proportional limit (percentage of modulus of rupture)			
average	70.7	74.0	71.6
maximum	73.8	71.8	77.8
minimum	69.2	73.7	67.2
Modulus of elasticity (p.s.i. $\times 10^{-6}$)			
average	1.99	2.12	1.99
maximum	2.24	2.32	2.31
minimum	1.71	1.91	1.71
Moisture content (per cent.)			
average	12.3	11.5	11.5
Specific gravity			
average	0.504	0.507	0.506

*All beams were 6 in. × 12 in. × 14 ft. long made with Douglas fir laminations having no visible defects.

TABLE 2.—Strengths of beams* which failed in flexure, showing the effect of joints in laminations

Type of joint	Number of laminations		
	8	11	17
Butt	75	81	77
Onsrud	63	80	73
Serrated scarf	95	91	84
Plain scarf 1:12	91	87	92
" " 1:8	94	97	92
" " 1:5	90	91	96

*All beams were 6 in. × 12 in. × 14 ft. long, made with clear Douglas fir laminations. Joints were in the bottom lamination at mid-span. Tabulated values are average results from tests of moduli of rupture of beams expressed as a percentage of the modulus of rupture of the control specimen without joints.

this same process would be applicable for the determination of permissible design stresses in glued laminated timber members, adjustment of certain factors should be made.

Residual strength factors of individual laminations are not correct measures of the strength of a member of which the lamination is a component. In general, because any defect will be limited in extent to the thickness of the lamination in which it is present, the residual strength factor will be higher for the built-up member than for the individual lamination graded as a joist or plank.

A most significant difference exists because of the fact that dried material is used in making glued laminated members. Permissible stresses for solid structural timbers are determined from strength tests on green material notwithstanding the fact that the members will be air-dry during most of their service life and in many cases before the design load is applied to them. The reason for not determining the design stress from strength of air-dry specimens rather than green specimens is that it is anticipated that additional defects will develop in the members accompanying the drying, usually checks, which will offset the increase in strength of the fibres. This argument is not applicable to glued laminated members and consequently allowance should be made for the fact that air-dry material is used in the manufacture.

Douglas fir, coast region, has an average modulus of rupture of 14,800 p.s.i. for air-dry clear specimens as determined by tests at the Forest Products Laboratory, Ottawa, Ontario.

Using the method outlined above and making appropriate adjust-

TABLE 3.—Effect of knots on the strength characteristics of beams which* failed in flexure

Value of $\frac{I_g - I_k}{I_g}$	1.0	0.911	0.870	0.832	0.781	0.742	0.730	0.700	0.633	0.589
Number of beams	85	10	10	10	10	10	10	10	10	10
Modulus of rupture average (p.s.i.)	9,905	8,953	8,757	8,780	7,370	7,089	6,366	6,184	4,872	4,847
Stress at proportional limit (percentage of modulus of rupture)	71.8	78.6	77.5	76.4	78.0	83.2	86.0	88.4	79.2	74.6
Modulus of elasticity average (p.s.i. $\times 10^{-6}$	2.04	2.08	2.05	2.06	1.97	2.00	1.92	1.93	1.78	1.77

*All beams were 6 in. × 12 in. × 14 ft. long, made of Douglas fir. Eighty-five were of clear material, $\frac{I_g - I_k}{I_g} = 1.0$, twenty-eight having 8 laminations, twenty-six having 11 laminations and thirty-one having 17 laminations. Thirty of the knotty beams had 8 laminations, sixty had 17 laminations.

I_g = gross moment of inertia of cross section. I_k = moment of inertia of parts of critical cross section occupied by knots.

ments in the various components of the gross factor of safety, the permissible design stress in flexure for permanent loading is calculated as follows:

Variability of manufactured product is not as great as with natural timber; use $a = 1.25$; $b = 1.78$; $c = 2.50$; $d = 1.25$: this will depend upon the size and location of defects. $K = a \times b \times c \times d = 6.95$.

$$\text{Permissible stress} = \frac{14{,}800}{6.95}$$

$$= 2{,}130 \text{ psi.}$$

A value of 2.50 for c the net factor of safety is used, rather than 1.67 which has been used in the C.S.A. specifications.

Duration of loading has an important effect on the ability of timber fibres to withstand load. The value of 1.78 for b has been established by a study of tests of various species loaded for different lengths of time. When tabulated strengths of clear specimens are based on short-time loading tests it is necessary to include this component, b, to obtain long-time or permanent loading strength. When loading of shorter duration is being considered, an appropriate increase in permissible stress may be made. Most present-day structural timber specifications give coefficients for adjustment of permissible stresses for durations of loading other than permanents. These adjustments should be applicable to permissible stresses in "Glulam" also.

When a lamination is curved, stress is induced in the fibres by the bending moment which is applied to produce the required curvature. To allow for these initial stresses the permissible stress should be reduced, depending upon the ratio of the radius of curvature to the thickness of the lamination. A suggested (4) reduction factor is;

$$1.0 - \frac{2{,}000t^2}{R^2} \text{ where: } R = \text{radius of curvature;}$$

t = thickness of lamination; $\frac{R}{t}$ shall be not less than 100.

Conclusions

Glued laminated timber is an effective structural material which is superior to sawn solid timbers in many applications. It will undoubtedly be used more extensively because of its aesthetic features and economic advantages.

Although clamping devices to provide pressure on the glue joints will produce a better member, satisfactory strength characteristics have

TABLE 4.—Results of tests of various glued laminated beams* which failed in flexure, showing the effect of using different species and different directions of laminations

Series	C	D	V	YP
Number of beams	85	14	15	8
Species	Douglas fir	Douglas fir	Douglas fir	Southern yellow pine
Direction of laminations	horizontal	horizontal	vertical	horizontal
Modulus of rupture (p.s.i.):				
average	9,905	8,870	8,460	9,130
maximum	11,440	9,890	10,520	10,810
minimum	8,595	7,410	5,760	7,348
Modulus of elasticity average (p.s.i $\times 10^{-6}$)	2.04	2.24	2.21	1.67
Moisture content average (per cent.)	11.8	11.6	13.2	11.2
Specific gravity (average)	0.507	0.533	0.528	0.530

*All beams were 6 in. × 12 in. × 14 ft. long. Most of the specimens were made with clear lumber: in the others only minor defects existed. In cases where defects existed their effects were evaluated in terms of clear specimens and the strength characteristics tabulated have been "adjusted to clear."

TABLE 5.—Results of tests of various glued laminated beams* which failed in shear

Series	C	D	V	K
Number of beams	54	8	12	14
Direction of lamination	horizontal	horizontal	vertical	horizontal
Value of $\frac{Ig \quad Ik}{Ig}$	1 0	1.0 to 0.965	1.0	1.0 to 0.81
Shearing stress at maximum load (p.s.i.):				
average	391	472	602	372
maximum	453	503	720	446
minimum	326**	431	505	332

*All beams were 6 in. × 12 in. × 14 ft. long, made with Douglas fir.

**This is exclusive of one beam which failed at 179 p.s.i. due to a shake observed before testing.

TABLE 6.—Results of compression tests on glued laminated Douglas fir columns* using clear and knotty material

	Laminations with knots				
	Clear material	No. 1 boards	No. 2 boards	No. 3 boards	Number of laminations
Stress at maximum load (p.s.i.)	7,980 7,560	6,340 6,850	5,670 5,830	4,580 5,470	8 17
Stress at proportional limit percentage of P/A at maximum load)	72.7 78.1	91.5 74.5	79.4 87.5	74.3 87.8	8 17
Modulus of elasticity (p.s.i. $\times 10^{-5}$)	2.25 2.30	1.96 2.58	1.48 2.32	1.30 1.65	8 17
Moisture content (per cent.)	11.6 11.0	11.3 11.5	11.4 11.4	11.0 11.0	8 17
Specific gravity	0.55 0.522	0.503 0.502	0.475 0.493	0.467 0.494	8 17
Average size of largest knot in each lamination (inches)	— —	1.11 1.12	1.86 1.97	2.73 2.67	8 17
Total number of knots	— —	15 38	17 30	12 23	8 17
Average size of all knots	— —	0.90 0.91	1.34 1.60	2.33 2.34	8 17

*Specimens 5.3 in. × 6 in. × 36 in. long:—each entry recorded in the table is the average for three specimens.

been produced using nails only to provide the required pressure on the joints.

In most instances, the saving in cost of lower strength species will not justify their selection because the cost of lumber is only a fraction of the cost of a glued laminated member.

For the proper utilization of this material it is essential that authoritative standards be established covering the manufacturing processes, inspection and grading of finished product and permissible stresses to be used in the design of members.

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TABLE 7.—Results of compression tests on glued laminated Douglas fir columns* using clear material with joints in laminations

	Control	Butt 0—0	Control	Butt 00—00	Control	Scarf 1 : 3 0—0	Control	Scarf 1 : 3 00—00	Control	Scarf 1 : 5 0—0	Control	Scarf 1 : 5 00—00	No. of laminations
Stress at maximum load (p.s.i.)	6,950	5,340	6,920	4,920	7,290	7,110	7,380	7,130	7,070	7,140	6,910	7,060	8
	7,340	5,970	7,250	5,580	7,300	7,330	7,030	7,070	7,080	6,950	6,940	6,870	11
	7,120	6,450	7,100	6,170	7,320	7,280	7,300	7,340	7,070	7,050	7,000	7,070	17
Stress at proportional limit percentage of of P/A at maximum load.	72.4	75.0	73.7	56.9	56.2	71.8	88.0	71.5	79.2	77.0	78.2	70.8	8
	79.0	67.0	74.5	64.5	62.2	71.8	79.7	73.6	76.3	73.4	67.7	74.3	11
	73.0	65.2	70.5	61.6	71.0	64.5	74.0	73.6	77.8	72.4	68.6	73.7	17
Modulus of elasticity (p.s.i. $\times 10^{-6}$)	1.83	1.26	1.61	1.35	1.34	1.95	2.22	2.01	1.88	1.92	1.64	1.95	8
	1.75	1.82	2.05	1.87	1.68	1.99	1.96	1.92	1.85	1.87	1.78	1.78	11
	1.80	1.84	1.93	1.94	1.83	1.74	1.74	1.94	1.91	1.92	1.83	2.04	17
Moisture content (per cent.)	10.3	9.9	10.5	10.1	10.2	10.3	10.6	10.5	10.7	9.9	10.4	10.6	8
	10.3	9.9	10.8	10.4	10.4	10.4	10.4	10.8	10.6	10.8	10.8	11.2	11
	10.1	10.6	10.3	10.9	10.0	10.0	10.9	11.1	10.2	11.3	11.3	11.2	17
Specific gravity	0.472	0.475	0.473	0.480	0.503	0.498	0.506	0.503	0.487	0.486	0.490	0.488	8
	0.493	0.485	0.494	0.496	0.500	0.502	0.491	0.492	0.499	0.495	0.502	0.499	11
	0.519	0.492	0.501	0.501	0.508	0.504	0.510	0.509	0.496	0.495	0.496	0.496	17

*Specimens 5.3 in. × 6 in. × 36 in. long:—Each entry recorded in the table is the average for three specimens.
0—0 indicates joints in outer set of laminations; 00—00 indicates joints in outer two sets of laminations.
All specimens 5.3 in. × 6 in. × 36 in. long:—Each entry recorded in the table is the average for three specimens.

TABLE 8.—Strength characteristics of Douglas fir columns with jointed laminations as a percentage of the corresponding characteristics of the control specimen

	Type of joint in laminations						
	Butt		Scarf 1 : 3		Scarf 1 : 5		Number of Laminations
	0—0	00—00	0—0	00—00	0—0	00—00	
P/A at maximum load	76.8	71.0	97.5	96.5	101.0	102.0	8
	81.3	77.0	100.3	100.5	98.0	99.0	11
	89.2	87.0	99.5	100.6	99.8	101.0	17
P/A at proportional limit	79.7	54.9	124.4	78.5	98.2	92.5	8
	68.8	66.6	106.1	92.9	94.5	108.5	11
	80.8	76.0	90.3	100.0	92.8	108.3	17
Modulus of elasticity	68.5	83.8	145.5	90.5	102.0	118.7	8
	103.0	91.3	118.4	98.0	101.0	100.0	11
	102.2	100.5	95.2	111.2	100.5	111.3	17

0—0 indicates joints in outer set of laminations; 00—00 indicates joints in outer two sets of laminations.
All specimens 5.3 in. × 6 in. × 36 in. long:—Each entry recorded in the table is the average for three specimens.

FROM MONTH TO MONTH

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

Co-operation on the West Coast

Members throughout Canada will be interested in an arrangement which has been made between the Vancouver Island Branch of the Institute and the British Columbia Engineering Society (Association of Professional Engineers of B.C.). This piece of news has to do with a set up of meetings between the two organizations.

The arrangement is that all meetings other than business meetings will be held jointly. The objective of course is to avoid duplication, to promote co-operation and to give the speaker a larger audience.

The first meeting was held on November 16th, 1951, and it is expected that several more meetings of this kind will be carried out as part of this season's program. The report received recently states that so far "the arrangement has proven very successful".

World Power Conference

The Canadian Committee of the World Power Conference met in Ottawa on Tuesday, March 18th. The first business was to consider the resignation of Dr. Camsell, who had acted as chairman since the inception of the Canadian Committee in 1924. Dr. Camsell had asked to be relieved of his duties because his present work brought him less into contact with the power interests than had been the case many years ago.

Dr. Camsell's resignation was accepted and appreciation of his many years of service was expressed.

Major-General Hugh Young was elected to replace Dr. Camsell, He is deputy minister of the Department of Resources and Development.

Routine business of the meeting included the approval of minutes of previous meetings and a report on the activities of the Conference since 1950, and discussions of future meetings.

It was agreed that the Canadian Committee would be represented at the meeting of the International Executive Council which is to be held in Chicago on September 4th, 1952, at the same time as the celebration of the Centennial of Engineering. It was agreed that Major-General Young should be the official delegate of the Canadian Committee, and that other representatives would also be in attendance.

Reference was made to a sectional meeting of the Conference which was set for Rio de Janeiro in 1954.

There was a long discussion relative to future work of the Canadian Committee in association with other world engineering organizations such as C.I.G.R.E. and the World Conference on Large Dams.

Nova Scotia Association

Election of officers and members of the Council of the Association of Professional Engineers for the year 1952, was announced some time ago.

Dr. D. J. MacNeil, M.E.I.C., is the president of the Association. His election as vice-president of the Engineering Institute is announced elsewhere in this issue of the *Journal*.

Other officers elected were G. J. Currie, M.E.I.C., of Nova Scotia Light and Power Co. Ltd., Halifax, vice-president.

Councillors in the Halifax area are: Wm. A. Devereaux, M.E.I.C., maritime manager, Bailey Meter Co., Ltd.; Dr. M. Roy Foran, M.E.I.C., professor of chemical engineering, Nova Scotia Technical College; T. P. Lusby, M.E.I.C., chief engineer, Provincial Department of Public Works; K. E. Whitman, M.E.I.C., consulting engineer. Councillors for areas outside of Halifax are as follows: Clyde Cameron, M.E.I.C., Maritime Steel and Foundries Ltd., New Glasgow; R. P. Nicholson, M.E.I.C., Dominion Coal & Steel Corp., Sydney; J. E. Clarke, M.E.I.C., divisional engineer, Department of Highways, Bridgewater; J. N. Ritchie, M.E.I.C., plant engineer, Robb Engineering Works, Amherst.

Cover Picture

View of Vancouver, Annual Meeting Headquarters for 1952, showing part of the Harbour.

WANTED—ENGINEERS

A report delivered at the 19th Annual Meeting of the Engineers' Council for Professional Development at Boston on October 20, 1951

by

Willis F. Thompson,

Chairman,

National Guidance Committee

I. Engineering Opportunities and Rewards

Since the beginning of the Korean war, nearly every newspaper has been carrying in their columns, help wanted advertisements for engineers. The shortage of engineers becomes greater with each passing month and has now reached a stage much more critical to the defence effort of the Nation than is the shortage of carbon steel, structural steel, alloy steel, stainless steel, copper, copper base alloys and aluminum. With the increased spending for armaments which will now occur due to recent acts of Congress, we can anticipate an engineering manpower shortage the severity of which will have no previous equal in any nation and which may easily result in a perceptible change to our existing social order.

There are now well over 400,000 engineers employed in all branches of the profession and, using conservative figures, we are now short well over 95,000 engineers. The demand for engineering graduates every year in the foreseeable future is placed at not less than 40,000 and reliable data indicates the demand is close to 45,000 and, mind you, this is after 52,000 engineers were graduated in 1950, the largest class ever to graduate, and 38,000 were graduated this year. These engineering graduates were immediately absorbed and the smaller class of 1952, which numbers about 25,000 will all be promised long before graduation day. The 1953 class, on the basis of present enrolments, will be a scant 19,000 and the 1954 class is expected to be even lower. Local draft boards may already have drafted a sufficient number of young men for the military service who are technically inclined to reduce the number of graduates to an insignificant low in 1955.

The present demand for engineers is not due entirely to our defence effort. At least 30,000 engineers each year are needed in this country for normal replacements and growth. The military services take in the order of another 15,000 engineers annually. Industrial research and development have increased more than 500 per cent since the beginning of World War II while the number of scientists and engineers has barely doubled. To this demand there must, of course, be added the large number of scientists and engineers who are now in government research.

From the best information obtainable at present, Russia is now producing 30,000 graduate engineers per annum from universities and 70,000 graduates from technical institutions. It should therefore be apparent to everyone in the engineering profession that, insofar as guidance work is concerned, we are very much behind schedule and every effort possible must be expended to keep the "pipe line" filled through which technical personnel are educated and developed.

I am not at all satisfied that industry is now using engineers efficiently. An engineer's training makes him easily adaptable to non-engineering positions in industry and many are now so engaged. Proper utilization of engineers in industry is now absolutely necessary if we are to make our maximum contribution to the nation.

It is unfortunate that it was necessary for so many engineers, both experienced and otherwise, during the 1930's to accept non-engineering positions to earn a livelihood. Many of these men are lost forever to the profession and this displacement, I believe, is one of the principal causes of our present shortage of engineers.

It is inevitable, therefore, that the shortage of engineers will create unparalleled opportunities for both men and women entering engineering study during at least the next ten years. I have been informed that one large electrical manufacturing concern announced lately it was planning to recruit 500 women college graduates in engineering, sciences and mathematics to help the engineering trained men in its organization. As the shortage of qualified men becomes more acute, the opportunities of qualified women in engineering become greater than ever before. Many young women with an aptitude for mathematics, the physical sciences and English have become very successful in engineering.

Considering the United States as a whole, the average engineer is in the same earnings class as the physician and the lawyer. Like them, his earnings vary widely with his ability and with business conditions as a whole, being significantly higher during booms and much lower during depressions. The median earnings for beginners, that is, those who have just been granted their college degrees, is now about $3,750 per year. The median earnings of engineers with 25 years of practice is now near $8,000 per year. The earnings of those who remain in the strictly technical brackets is less than those who take on administrative duties. There is, as in every other profession, a minority who lack the drive, or the teamwork personality to achieve high earnings and, at the other end of the scale, there is a minority embracing those who reach $15,000 or more about 20 to 25 years after graduation.

As in all careers, and especially in the professions, the rewards of engineering may be regarded as coming from several sources, such as

(a) Personal satisfaction with the actual activity of the occupation.
(b) Social satisfaction because of the usefulness of the services rendered.
(c) Financial satisfaction arising from the earnings received.

II. ECPD and its Objectives Through Student Guidance

Probably the most conspicuous of these accomplishments is its program of accrediting engineering curricula which has been conducted by its Education Committee. As of October 1949 some 991 curricula had been inspected, evaluated and 734 accredited at 146 degree granting institutions in the United States. 25 curricula had been accredited at 13

technical institutes in an initial extension of the accrediting program of this type of training.

Like any other organization, ECPD must depend upon the efforts of individual members of its engineering societies affiliates who are interested in and have become familiar with its objectives. These objectives are: to co-ordinate and promote efforts to attain higher professional standards of education and practice, greater solidarity of the engineering profession, and greater effectiveness in dealing with technical, economic and social problems.

ECPD is not an independent body but derives financial support and its administrative personnel from its constituent organizations.

One of the basic ECPD concepts is that there are four normal stages in the life of the engineer and the profession as a whole must recognize that it has a responsibility in each stage as the engineer advances through life. The four stages are: 1. The pre-college stage; 2. The undergraduate stage; 3. The engineer-in-training stage; 4. The stage of full professional practice.

The Guidance Committee of ECPD is interested in the first, or the pre-college stage and we concern ourselves mostly with students at the secondary school level who are qualified to enter the engineering profession. It is our purpose to provide these students with a means for educational and vocational orientation with respect to the opportunities and responsibilities of the profession. Our most important work is to assure that only those having the personal qualities, aptitudes and capacities required of engineers will seek entrance to the profession through engineering schools. The Committee's objectives as set forth in ECPD's Charter and Rules of Procedure are as follows:

"The Guidance Committee shall develop and review regularly, methods for guiding young men who seek entrance to the engineering schools so that those who enter will have the high quality, aptitude, and capacity required of engineers in the particular branches of engineering that they select. The Committee shall develop, and modify when necessary, an active program of co-operation with engineering and other groups so that the guidance methods developed will be put to useful purpose. The Committee shall report annually what response has been received to its program".

The attainment of the Committee's principal objectives involves:

1. "The supplying of information to each student or potential student concerning the qualifications essential for success in the profession of engineering.
2. "Continuing assistance to the various local engineering groups and their agencies which guide high school students in the selection of first year college curriculum.
3. "Stipulation of a more active participation of the local organization of ECPD constituent societies in the active promotion of ECPD objectives at the community level."

III. How the ECPD Guidance Committee Functions

The National ECPD Guidance Committee at present, is composed of eleven members. The United States has been sub-divided into eight regions, each of which has a regional chairman who is a member of the Guidance Committee. The regions are as follows:

Region I: New England.

Region II: New York and New Jersey.

Region III: Pennsylvania, Maryland, Delaware, Dist. of Columbia.

Region IV: Virginia, North Carolina, South Carolina, Tennessee, Mississippi, Alabama, Georgia, Florida.

Region V: Michigan, Indiana, Ohio, Kentucky, West Virginia.

Region VI: North Dakota, South Dakota, Nebraska, Wisconsin, Minnesota, Iowa, Michigan, Illinois.

Region VII: Oregon, Washington, California, Nevada, Idaho, Utah, Arizona.

Region VIII: Wyoming, Colorado, New Mexico, Kansas, Oklahoma, Texas, Arkansas, Louisiana.

It is planned that Canada will also be subdivided into regions. The boundaries of each region will be that of a province. It is expected that Alaska and Hawaii will each be one region.

Every state in each region in the United States will have a state chairman who will be selected by the regional guidance chairman. The state chairman, in turn, will select their county, city and town chairmen. The National Guidance Committee has no intention of interfering with local procedure or autonomy and the national network will disseminate information as to guidance methods used in various localities which seem to have advantage and which other localities may wish to adopt after trial.

We believe that the work of guidance can best be accomplished by having regional and state guidance committees come under the leadership of ECPD. The ECPD Guidance Committee is recommending to its regional chairmen:

1. State and local forums for discussion of improved methods of procedure.
2. The exchange of ideas as to how best to obtain the co-operation of boards of education and high school principals.
3. Organization of a speakers bureau which will cover completely the field of engineering, at least, civil, electrical, mechanical, mining and chemical engineering.
4. The accumulation of lists of publications now available to aid those engineers who volunteer to engage in this valuable contribution to industry, to the profession and to the coming generation of American citizens.

* * *

Recently the Engineering Manpower Commission of the Engineers' Joint Council has contacted by mail some 23,000 high school principals, sending each a copy of our booklet *Engineering as a Career* and we are requesting our regional and state organizations to follow up these contacts as soon as possible.

The Engineers' Joint Council recently scheduled a full scale meeting of engineers from various societies throughout the United States and Canada in Pittsburgh. At that meeting facts about shortages of engineers were discussed in detail and the delegates were urged to set up or assist in local programs to counteract the shortage. Recent action by Charles E. Wilson, Defense Mobilizer, in setting up a commission for specialized manpower, headed by Dr. Arthur Fleming, may help in solving some of the problems concerning the manpower shortage. The Engineers' Joint Council has suggested to Dr. Fleming that steps should be taken in halting the employment of engineers in positions that do not have to be filled by technical men in both industry and the armed forces. The Council further implored the new commission not to shut off the flow of students to engineering colleges in the attempt to maintain an army of 3,500,000 men.

The flow of high school graduates to engineering colleges and technical schools would with our present guidance organization, be maintained except for interference by the Selective Service system, which seems disposed to commit all the errors of World War II all over again.

The Engineering Manpower Commission and other interested groups are urging deferment of an adequate number of college students in engineering and science at undergraduate and advanced levels. A bill was introduced in Congress to make this deferment mandatory but it failed to be enacted into law. All deferments are therefore acted upon at the local level.

IV. Students and Counsellors

It should be remembered that high school graduating classes are now composed of boys and girls who were born in the depression of the early 1930's. Many of their parents have lived on relief and their children have been exposed to a philosophy of life quite foreign to the system of government under which we received our elementary education.

High school counsellors are found to be usually part of the faculty and in many instances have between 200 and 300 students to counsel not only in engineering but also in other professions and vocations. In a good many instances, these counselors have the dual job of acting both as parent and counsellor and it is well known to all of us who have been interested in guidance in the past how difficult it is for boys and girls who have not had proper guidance from their parents.

It should be mentioned that, while we live under a war and peace economy, high school teachers who are good counsellors and reside in industrial areas are exposed to the lure of higher salaries offered by industrial concerns who are continuously in the market for trained men in the field of personnel work. Many good high school teachers and counsellors were lost to industry during World War II and the same thing is happening now. Counsellors who are part of the high school faculty must not only maintain their home room discipline but, in some instances, teach as many as one half dozen or more classes per day. Therefore, it should be apparent to everyone that any assistance which they can receive in guidance work will be greatly appreciated.

Those of us who are interested in guidance and may have been in direct contact with boys and girls of the present high-school age, cannot help but have been impressed not only with their high level of intelligence but also with their sincere and earnest desire to become good citizens. It is my opinion that, at no time in our country's history, have we, on the average, produced better high school students in spite of the time and circumstances under which we now live.

V. What Aptitudes are Required?

The best prospect for successfully completing the engineering college course is the industrious high school student who shows:

1. Ability to get along well with his fellow students.
2. Scholastic proficiency, particularly in mathematics, the physical sciences and in English.

Students who score in the top third of their class on standardized tests in mathematics and physical sciences should be encouraged to follow the strongest sequence of English, mathematics and the science courses available to them. In this way, they can best prepare themselves for entrance to the engineering college of their choice.

Aptitude tests which are considered to be especially useful for seventh through twelfth grade students are available through the Co-operative Division, Educational Testing Service, 20 Nassau Street, Princeton, N.J. These tests, now being used in several areas, are achievement tests in mathematics, physical science, and in English and have been found repeatedly to yield good predictions of scholastic success in engineering.

In many engineering colleges a mathematics test of the appropriate level has provided better prediction for entering freshmen than a scholastic aptitude test. A scholastic aptitude test often predicts about as accurately as do secondary school grades. Good scholastic aptitude tests such as the American Council on Education Physchological Examination for High School Students or the Scholastic Aptitude Test of the College Entrance Examination Board could be used.

VI. Recommendations

Here are ten suggestions which, I am sure, will help to reduce the shortage of engineers in the future. They are:

1. Give every assistance to your ECPD state chairman in organizing guidance committees.
2. All ECPD state chairmen should notify the Selective Service authorities in their states that guidance committees are available to every draft board for consultation regarding deferment of technically inclined high school students.
3. The ECPD Guidance Committee in every area should notify the local high school principals and counsellors that their committee is available and ready to assist in counselling students who wish information in connection with an engineering education.
4. The ECPD Guidance Committee in every area should learn who the honorary chairman and the chairmen of the high school science clubs are and inform them that speakers are available to talk to the clubs about the possibilities existing in the engineering profession.
5. State and local ECPD Guidance Committees should hold forums for discussion in improved methods of procedure.
6. The State and local ECPD guidance committees should suggest to local professional engineering chapters, sections, councils, and other engineering groups that at least one of their meetings this winter should concern itself with the shortage of engineers.
7. Every member of the engineering profession should inform his clients, his associates, his friends and neighbours of the existing critical shortage of engineers with the purpose of directing more young people into the profession and guidance committees should also attempt to convince a great many engineers now retired that at least for the next few years they should again resume an active part in the work of the profession.
8. Where industry is not using engineers to the full extent of their ability, the local ECPD committees should find ways and means of bringing the matter to the attention of the proper officials directly concerned.
9. Where our armed forces are known not to make the most suitable use of engineers who have been called or drafted into the service, the regional chairman of ECPD should obtain and forward complete information to the National Guidance Committee.
10. All engineers and others interested in guidance work should send to their local ECPD guidance committee suggestions that may improve engineering guidance and the names and addresses of those qualified to serve on regional committees or otherwise to contribute to the progress of guidance work.

Centennial of Engineering

Twelve of the nation's leading engineers were named today to act as chairmen for the special general meetings comprising the convocation period of the Centennial of Engineering to be held in Chicago this summer.

The convocation, which is scheduled from September 3 to 13, is expected to bring more than 25,000 leaders in American and foreign engineering bodies to Chicago. Already 51 American groups comprising practically all phases of engineering are pledged to participate in the convocation program, together with nine foreign societies from Great Britain, France, Japan, India, Mexico and Canada. The convocation general meetings will be in addition to the more numerous technical meetings planned by the individual societies.

Other Centennial features, including a dramatic presentation depicting man's technical progress from the days of the cavemen to the harnessing of the atom, and a special exhibit, both to be staged at the Museum of Science and Industry in Chicago, will open earlier in the summer. The latter features are planned primarily for the general public and are expected to be seen by more than a million visitors. They will portray the key factors that have contributed most to the high standard of the American way of life.

The 12 convocation session chairmen, as announced by Lenox R. Lohr, Centennial president, and the engineering subjects to be covered under their respective leaderships, are:—

Food—Clarence Francis, chairman of board, General Foods Corporation, New York, New York.

Tools—Kenneth M. Condit, dean, School of Engineering, Princeton University, Princeton, New Jersey.

Structures and Construction — Waldo G. Bowman, editor, *Engineering News-Record*, 330 West 42nd Street, New York 18, New York.

Transportation — Charles F. Kettering, research consultant, General Motors Corporation, Box 188, North End Station, Detroit, Michigan.

Mineral Industries — Clyde E. Williams, director, Battelle Memorial Institute, Columbus, Ohio.

Chemical Industries — F. J. Curtis, vice-president, Monsanto Chemical Company, St. Louis, Missouri.

Communications — William H. Harrison, president, International Telephone & Telegraph Company, 67 Broad Street, New York 5, New York.

Energy — Eugene Ayres, technical assistant to executive vice-president, Gulf Research and Development Company, Pittsburgh, Pennsylvania.

Industrial Management Society Awards

A methods achievement competition was sponsored by the Industrial Management Society at its 15th Annual Clinic held in Chicago last November.

The Northern Electric Co. Ltd. of Montreal was one of three Canadian firms to enter this competition and won second place. The winner of first place was the General Motors Corporation, Inland Division of Dayton, Ohio, and third place went to the A. O. Smith Corporation of Kankokee, Illinois. Other firms entered in the contest were Eastman Kodak, Timken Roller Bearing, Zenith Radio, etc.

The method simplification presented by the Northern Electric Company dealt with an improvement in fitting a bronze pin into a brass sleeve whereby a partly manual operation was replaced by one carried out almost entirely by compressed air power. The entire procedure was presented by means of a 16 mm. coloured film, prepared by Northern engineers, entitled "Partners in Progress".

Dr. Lillian Gilbreth, Hon. M.E.I.C. presented bronze plaques to the winners on behalf of the Society. J. R. Houghton, M.E.I.C., manufacturing engineering superintendent, accepted for the Northern Electric Company Limited.

News of Other Societies

At the annual general meeting of the **Association of Consulting Engineers of Canada** in Montreal, in February, H. H. Angus was elected Dominion president of the Association (see Personals).

E. A. Ryan, M.E.I.C., of Montreal is retiring president. Other officers named were A. T. Hurter, M.E.I.C., of Montreal, vice-president; and F. J. Friedman, M.E.I.C., of Montreal, vice-president. The executive committee includes J. G. Chenevert, M.E.I.C., and Mr. Ryan and Mr. Hurter. Other directors are E. A. Cross, M.E.I.C., of Toronto, and G. Lorne Wiggs, M.E.I.C., of Montreal.

The **Royal Society of Canada** will meet May 31 to June 1, 1952, in Quebec City.

At a January meeting of the council of the Quebec Provincial Division of the **Community Planning Association of Canada,** C. E. Campeau, M.E.I.C., of Montreal, was named president of the di-

vision (see Personals). Harold Spence-Sales, and Andre Duval, were named vice-presidents.

At the annual meeting in November, 1951, of the Montreal Branch of the **University of Toronto Engineering Alumni,** H. C. Karn, M.E.I.C., was elected president. First vice-president is W. W. Timmins; 2nd vice-president, A. R. Colman; secretary, C. A. Parkinson.

The 62nd annual convention of the **Canadian Electrical Association,** (Room 704, Tramways Bldg., Montreal 1) will be held at Banff Springs Hotel, Banff, Alberta, June 30, and July 1 and 2, 1952.

The 1952 meeting of **Canadian Building Officials** is scheduled for May 9 and 10 at Windsor, Ont., immediately preceding the meeting of the Building Officials Conference of America at Detroit, Michigan, May 11 to 15. Information can be obtained from the Secretary of the Associate Committee on the National Building Code, National Research Council, Ottawa.

The 35th annual conference and exhibition of **The Chemical Institute of Canada** (18 Ridcau St., Ottawa, 2, Ont.) will take place in Montreal, June 2, 3, 4, 1952, at the Mount Royal Hotel.

Information about the program is available from C.I.C. headquarters.

On February 7, 1952, at the Ninth Annual Meeting of the **Canadian Fan Manufacturers' Association,** officers elected for the ensuing year were Mr. W. C. Caldwell, president; Mr. C. W. Johnson, vice-president; and L. O. Monroe, secretary-treasurer.

Mr. Caldwell is the sales manager of Sheldons Engineering, Ltd., Galt, Ontario, and Mr. Johnson is vice-president and general manager of Canadian Sirocco Company, Ltd., Windsor, Ontario.

The 50th anniversary annual meeting of the **American Society for Testing Materials** (1916 Race Street, Philadelphia 3, Pa.) is scheduled for June 23-27, at the Hotels Statler and New Yorker, New York City.

Exhibits of testing apparatus and laboratory supplies and a photographic exhibit will be features of the meeting, as well as the H. W. Gillett memorial lecture, and 35 sessions.

The **Massachusetts Institute of Technology** (Cambridge 39, Mass.) announces a special program in the colloid chemistry of elastic high polymer in science and industry. The course, planned to be of interest to those in the production and industrial applications of natural and synthetic elastomers, will take place from June 16 to July 5, 1952. Dr. E. H. Huntress, director of the Summer Session, will receive applications.

The annual spring meeting of the **Society of Naval Architects and Marine Engineers** (29 West 59th St., New York 18, N.Y.) will be held at New Orleans, La., May 1 and 2, with headquarters at the Roosevelt Hotel.

Enquiries regarding the 1952 spring meeting of the **Society for Experimental Stress Analysis,** May 14, 15 and 16, at Indianapolis, Indiana, should be addressed to the meeting chairman, W. V. Covert, c/o Diamond Chain Company, Inc., Indianapolis 7.

The summer meeting of the **Society of Automotive Engineers** (29 West 39th St., New York 18, N.Y.) will take place June 1-6, at Atlantic City, N.Y., at the Ambassador and Ritz-Carlton Hotels.

Coming meetings of the **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.) include those scheduled for: May 11-14, 1952, at French Lick Springs Hotel, French Lick, Indiana; September 11-13, 1952, at Palmer House, Chicago, Ill.; and the annual meeting, December 7-10, 1952, at Hotel Cleveland and Carter Hotel, Cleveland, Ohio.

The seventh national chemical exposition is to take place in Chicago, U.S.A., September 9-13, 1952. The office of the Exposition is at 86 East Randolph St., Chicago 1, Illinos.

The third mechanical handling exhibition and convention will be held at Olympia, London, June 4 to 14, 1952, with "Greater Output at Lower Costs" as the theme. Papers and discussions will be sponsored by the Institution of Production Engineers, the Industrial Truck Manufacturers Association, the Mechanical Handling Engineers Association, and the Association of Crane Makers.

The European Convention of Chemical Engineering will take place in Frankfurt am Main, Western Germany, May 18-25, 1952. Meetings of technical and scientific societies, a large exposition of chemical apparatus and equipment are scheduled to take place at the same time. as well as the 25th International Congress of Industrial Chemistry. Information can be obtained from the office of the National Chemical Exposition, 86 East Randolph Street, Chicago 1, Illinois.

The 14th congress of the **International Conference on Large Electric Systems** (C.I.G.R.E.) will take place in Paris from May 28 to June 7, 1952.

The Conference, founded in 1921, is an international centre for the exchange of electrotechnical information, attended every two years by specialists on large generating stations and high tension lines.

The Congress provides the very latest information on progress realized throughout the world on all questions relating to the construction and operation of high tension lines, on experiments made, practices applied in operation, apparatuses used in service, etc.

Its international character is emphasized by the fact that in 1950 it brought together 1,252 members who came from 42 different countries, and the official representations of the electrical services of 22 governments.

The Canadian National Committee of C.I.G.R.E. is headed by G. A. Gaherty, M.E.I.C., president, Calgary Power Company, Montreal

66th

ANNUAL GENERAL AND PROFESSIONAL MEETING

of

THE ENGINEERING INSTITUTE OF CANADA

at

THE HOTEL VANCOUVER, VANCOUVER, B.C.

May Seventh to Ninth
1952

COMMITTEE

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Vice-Chairman . . . . . J. P. MACKENZIE
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NOTE: See separate program for ladies' events.

*Program

WEDNESDAY, MAY 7TH

9:00 a.m. ***REGISTRATION***

10:00 a.m. ***MAYFAIR ROOM***

A NEW CANADIAN AIRCRAFT,
THE DEHAVILLAND "OTTER"

R. D. Hiscocks, M.E.I.C. and F. H. Buller,
The DeHavilland Aircraft of Canada Limited,
Toronto.

SALON A

COLUMBIA CELLULOSE COMPANY'S
WATSON ISLAND MILL

Charles H. Klotz, Supervising Engineer,
Celanese Corporation of America,
New York, N.Y.

11:00 a.m. ***MAYFAIR ROOM***

R.C.A.F. RESEARCH AND DEVELOPMENT

Dr. J. J. Green, M.E.I.C.,
Chief of Division "B",
Defence Research Board, Ottawa, and
Scientific Adviser to the CAS, R.C.A.F.

SALON A

PROBLEMS RELATED TO ALBERTA
NATURAL GAS

Dr. G. W. Govier, University of Alberta and
Technical Member of the Petroleum and
Natural Gas Conservation Board of Alberta,
Edmonton.

2:15 p.m. ***MAYFAIR ROOM***

THE OPPORTUNITY FOR CANADIAN
ENGINEERS IN THE FIELD OF CANADIAN
AIRCRAFT DEVELOPMENT

J. A. Morley, Director of Sales and Services,
A. V. Roe Canada Limited, Toronto.

SALON A

TRANS MOUNTAIN PIPE LINE

S. M. Blair, Vice-President,
Trans Mountain Oil Pipe Line Company,
Toronto.

3:15 p.m. ***MAYFAIR ROOM***

PERFORMANCE OF SAWMILL HEADRIGS

D. S. Smith, Assistant Director,
British Columbia Research Council,
Vancouver.

SALON A

THE KOOTENAY LAKE SPAN

E. M. Stiles, M.E.I.C., Chief Engineer,
Consolidated Mining and Smelting Company
of Canada, Limited, Trail.

4:15 p.m. ***MAYFAIR ROOM***

MUSKEG CONSTITUTION

Dr. N. W. Radforth, McMaster University,
Hamilton, and National Research Council.

SALON A

CORROSION IN INDUSTRY

Bruce Levelton,
Assistant Research Engineer,
British Columbia Research Council, Vancouver.

Luncheon

12:30 p.m. ***BANQUET HALL - $2.50***

Speaker, R. G. JOHNSON,
President, Defence Construction
Limited.
"The Defence Construction Program"

Dinner

7:00 p.m. ***BANQUET HALL - $3.50***

Speaker, DR. IRA P. MACNAB,
M.E.I.C., Retiring President.
"Canada, My Home".

Dress Informal

8:30 p.m. ***BANQUET HALL***

ANNUAL GENERAL MEETING

Reports and election of Officers.

*Subject to minor change.

THURSDAY, MAY 8TH

9:30 a.m. ***SALON A***

NECHAKO-KEMANO-KITIMAT HYDRO-ELECTRIC POWER DEVELOPMENT AND ALUMINUM REDUCTION PLANT

F. L. Lawton, M.E.I.C., Chief Engineer, Power Department, Aluminium Laboratories Limited, Montreal.
J. S. Kendrick, M.E.I.C., Assistant Project Manager, Aluminum Company of Canada Limited, Vancouver.

10:30 a.m. ***SALON A***

THE SPRAY HYDRO-ELECTRIC POWER DEVELOPMENT

G. V. Eckenfelder, M.E.I.C., Resident Engineer, Montreal Engineering Company, Limited, Montreal.

10:30 a.m. ***MAYFAIR ROOM***

PANEL DISCUSSION

The fields of interest and activity of the Engineering Institute of Canada and The Provincial Professional Associations.

11:30 a.m. ***SALON A***

LARGE STEAM ELECTRIC STATIONS OF THE ONTARIO HYDRO

S. L. Fear, M.E.I.C., Liaison Engineer, The Hydro Electric Power Commission of Ontario.
T. A. Fearnside, Mechanical Engineer, Stone and Webster Engineering Corporation.
R. A. H. Hayes, M.E.I.C., Electrical Engineer, H. G. Acres and Company.

12:30 p.m. ***LUNCHEON - Informal - No speaker***

2:00 p.m. ***VISITS***

Fraser River model.
Plywood plants.
Fish cannery.
Cleveland Dam.

7:15 p.m. ***BOAT TRIP — VANCOUVER HARBOUR***

A buffet or box lunch supper will be served en route. Returning about 10.30 p.m.

HOTEL ACCOMMODATION AND TRANSPORTATION

The Hotel Vancouver is the headquarters hotel and all meetings and functions will take place there unless otherwise noted. Additional room accommodation has been arranged at the Devonshire and Georgia hotels across the street from the headquarters hotel.

You are urged to make requests for room reservations as early as possible. Single rooms are very scarce, therefore in most instances it will be necessary for you to share a twin-bedded double room. It is better if sharing arrangements can be worked out in advance and indicated on the application for reservations.

All requests for reservations should be addressed to:—

The General Secretary,
The Engineering Institute of Canada,
2050 Mansfield Street,
Montreal 2, Que.

Special reduced convention fares have been authorized for rail travel in Canada. If you require a special fare certificate, it will be mailed to you from headquarters. This entitles you and members of your family to round-trip tickets at one and one-half times the one-way fare plus twenty-five cents.

Trans-Canada Air Lines have special convention rates for parties of ten or more. Your local T.C.A. agent will gladly supply details.

No matter how you travel be sure to make your reservations now to avoid disappointment.

REGISTRATION

3:00 p.m. to 6:00 p.m. — MAY 6

9:00 a.m. to 6:00 p.m. — MAY 7-9

Members $5.00

Juniors $3.00—Non-members $6.00

Ladies, guests of the Institute, speakers, authors and students—complimentary.

"MURIEL'S ROOM"

"Muriel" will again extend her hospitality to all registered members, ladies and guests, thanks to the continued co-operation of Canadian industry.

YOU MUST WEAR YOUR REGISTRATION BADGE

PLEASE NOTE

Prices for meals include provincial tax but NOT gratuities. Tickets must be obtained in advance and refunds cannot be made less than three hours in advance of any function.

"WELCOME TO VANCOUVER ISLAND"

Special post-convention trip—May 10-11

Vancouver Island Branch, E.I.C., extends a cordial welcome to members of the Institute and their wives to visit Vancouver Island at the conclusion of the Annual Meeting in Vancouver.

Full particulars have been mailed to all members, but for further information consult the registration desk.

FRIDAY, MAY 9TH

9:30 a.m. ***MAYFAIR ROOM***

HISTORY AND PRESENT STATUS OF POWER DEVELOPMENT FROM THE WIND

H. E. Parsons, Head,
Engineering Design Section,
Radio and Electrical Engineering Division,
National Research Council, Ottawa.

SALON A

STRUCTURAL TIMBER

W. Thornber, M.E.I.C., Timber Engineer,
B.C. Coast Woods Trade Extension Bureau,
Vancouver.

10:25 a.m. ***MAYFAIR ROOM***

THE ORGANIZATION AND FUNCTIONS OF AN INSTRUMENT DEPARTMENT

A. H. W. Busby, M.E.I.C., Superintendent of Engineering Research and Development.
W. G. Small, Supervisor of Instrument Section,
Research and Development Division,
Consolidated Mining and Smelting Company of Canada, Limited, Trail, B.C.

SALON A

ECONOMIC ASPECTS OF FLOOD CONTROL

J. B. Carswell, M.E.I.C.,
Kitimat Constructors Limited, Vancouver.

11:20 a.m. ***MAYFAIR ROOM***

RURAL ELECTRIFICATION IN BRITISH COLUMBIA

Garth Griffiths, M.E.I.C.,
Deputy Chief Engineer,
British Columbia Power Commission, Victoria.

SALON A

PRECAST REINFORCED CONCRETE FRAMES

E. M. Rensaa, M.E.I.C.,
Main, Rensaa and Minsos, Edmonton.

Luncheon

12:30 p.m. ***BANQUET ROOM - $2.50***

Speaker, FRANK K. SHALLENBERGER, Associate Professor of Industrial Management, Stanford University, Stanford, California.

"THE PUSH BUTTON FACTORY"

2:15 p.m. ***MAYFAIR ROOM***

AN INTEGRATED FOREST PRODUCTS OPERATION

J. O. McCutcheon, Jr.E.I.C., Manager,
Alberni Plywoods Division,
McMillan and Bloedel Limited,
Port Alberni, B.C.

SALON A

PREFABRICATED VESSELS FOR INLAND WATERS

Arthur McLaren, Managing Director,
Allied Builders Limited, Vancouver.

3:15 p.m. ***MAYFAIR ROOM***

MANAGEMENT PANEL DISCUSSION

"Management, Safety and the Engineer"

The Annual Banquet

7:30 p.m. ***DINNER - BANQUET HALL***

$5.00 per person (including dance)

Speaker, Dr. N. R. Crump, M.E.I.C., Senior Vice-President, Canadian Pacific Railway Company.

"MODERN PIONEERS"

Chairman, Dr. Ira P. Macnab, President of the Institute.

Presentation of medals and prizes, introduction of the new president, Dr. J. B. Stirling, and new members of the Council.

Dress Optional.

Annual Dance

9:30 p.m. ***THE BALLROOM***

$2.00 per person (dance only)

RECEPTION

After the banquet there will be an informal reception in Salon A when members and guests may meet the incoming and retiring presidents, the chairman of the Vancouver branch, S. H. deJong, the chairman of the Annual Meeting Committee, T. Ingledow, and their wives.

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Ltd., Hamilton, Ont.

Karsh, Ottawa

John B. Stirling, M.E.I.C.

President

of

The Engineering Institute of Canada

1952

Mr. Stirling was born at Dundas, Ontario, and after receiving his early education there, proceeded to Queen's University from which he graduated in 1909 in Arts and in Engineering in 1911. Following graduation, he worked on construction projects in the prairie provinces as well as in Ontario until 1917. He then joined the Canadian Expeditionary Force and served overseas with the Royal Canadian Engineers until the end of the War.

In 1915 Mr. Stirling joined the staff of E. G. M. Cape and Company, engineers and contractors of Montreal as a field engineer. He returned to the Company at the end of the war and acted for it as supervising engineer on many construction projects throughout Canada. These included the Canadian Vickers plant in Montreal, the Banting Institute in Toronto as well as docks and grain elevators at Saint John, N.B. and at Georgian Bay ports. He became a partner in the firm in 1928, was made vice-president in 1940 and president in 1950.

Mr. Stirling has been prominent in the affairs of the Canadian Construction Association for many years and was president of that organization in 1942 and 1943. He served as president of the Corporation of Professional Engineers of Quebec in 1948 and was elected president of the Montreal Board of Trade in 1950. In addition to these many activities he is on the boards of two Montreal hospitals as well as being a Trustee of Queen's University and president of the Queen's Alumni Association. Last year his alma mater conferred on him the honorary degree of Doctor of Laws.

His connection with the Engineering Institute dates back to 1913 when he joined as an Associate Member, transferring to Member in 1934. Mr. Stirling has served on the executive committee of the Montreal Branch from 1939 to the present. He was Branch chairman in 1945, councillor in 1946, and vice-president in 1951. He has also been chairman of the Institute Committee on Professional Interests from 1944 to 1950 and is now chairman of the Finance Committee.

Doctor Stirling's record has been an outstanding one and there is no doubt that he will add prestige to the Institute during his coming term of office.

Newly Elected Officers of the Institute

Dr. Albert E. Berry. M.E.I.C., of Toronto, has been elected a vice president of the Institute.

Dr. Berry has been director of the Sanitary Engineering Division, Ontario Department of Health, since 1926, with supervision over water supplies, sewage works, stream sanitation, milk supplies, food sanitation and general sanitation in the province. He is a graduate in civil engineering from the University of Toronto, holding degrees of M.A.Sc. and C.E., and also that of doctor of philosophy in public health from the University of Toronto.

Dr. Berry has been active in professional associations and his offices can be listed as follows: past president of the Federation of Sewage and Industrial Wastes Associations; past chairman of the Toronto Branch of the Engineering Institute of Canada; past vice-president, American Public Health Association; past president of the Fuller Award Society of the American Water Works Association; Registered Professional Engineer of Ontario; president, 1951-52, of the American Water Works Association.

Among his activities there has been his work as a member of the Board of Review on Sewage Disposal for Toronto; a member of the Advisory Board to the International Joint Commission on Boundary Waters Pollution; secretary of the Canadian Section of the American Water Works Association and the Canadian Institute on Sewage and Sanitation.

Dr. Berry's professional activities have had recognition. He has been selected to receive the Fuller Award of the American Water Works Association for outstanding service in water works field; the Kenneth Allen Award of the Federation of Sewage and Industrial Wastes Associations for outstanding work in the sewage field; and the John M. Goodell Prize of the American Water Works Association for work on fluoridation of water supplies.

He served with the Royal Engineers in World War I.

Dr. Berry joined the Engineering Institute as an Associate Member in 1921, transferring to Member in 1934.

A. E. Berry, M.E.I.C.

G. T. Malby, M.E.I.C., has been elected a vice-president of the Institute.

Mr. Malby was born at Winnipeg, Man., and studied at St. John's Technical High School, there. He graduated with the degree of B.Sc. in civil engineering from the University of Manitoba in 1935. Prior to graduation he did summer work on construction and survey with the City of Winnipeg Hydro; and also on bridge construction with McDonald and McDonald, general contractors. Taking a year out from University he worked with the Northern Trust and Mortgage Company in Winnipeg.

Upon graduation he was employed by the Manitoba Government Roads Department as a field engineer. In 1936 he was engaged on aerial mapping for the Aerial Surveys Branch, Dominion Department of Mines, Ottawa. Joining the engineering staff of Saguenay Power Company, Arvida, Que., in 1937, he worked on design, construction and survey.

He transferred to the Aluminum Company of Canada, Ltd., in 1939 as assistant resident engineer on construction. In 1942 he became resident engineer for the Company in charge of construction of plants at Shawinigan Falls and La Tuque, Que. He was also on the operating staff of the LaTuque Plant as mechanical superintendent. In 1944 he was transferred to Alcan's Arvida Works as assistant mechanical superintendent. In 1948 he went to the Company's general engineering department in charge of all construction and as inspector of maintenance of all buildings and structures. In 1950 he became resident engineer in charge of construction of the 250,000-hp. development at Chute du Diable on the Peribonka River, where he is located at present.

G. T. Malby, M.E.I.C.

Mr. Malby is a member of the Corporation of Professional Engineers of Quebec. He joined the Institute as a Student in 1931, transferring to Junior in 1938, and to Member in 1947. He was elected a councillor of the Saguenay Branch in 1949.

Dr. Donald J. MacNeil, M.E.I.C., of Antigonish, N.S., has been elected a vice-president of the Institute. He is head of the Department of Geology of St. Francis Xavier University, Nova Scotia.

Dr. MacNeil was born in Sydney, Nova Scotia.

He was an engineering assistant in the Planning Bureau of New York Edison Co., from 1925 to 1928. He obtained a B.Sc. degree in geology at St. Francis Xavier University, N.S., in 1930; and that of Ph.D. in geology from Princeton University, New Jersey, in 1935.

D. J. MacNeil, M.E.I.C.

He worked as a petroleum geologist for Shell Oil Company, in Oklahoma and Texas, for four years thereafter, and he worked in the same capacity for the Texas Company, in Illinois and Alberta, from 1941 to 1946. Dr. MacNeil accepted his present position in 1946.

Among his current activities and offices are those of lecturer in geology, Massachusetts Institute of Technology; president, Association of Professional Engineers of Nova Scotia; president, Mining Society of Nova Scotia; regional vice-president, Princeton Alumni Association of Canada. He is a member of the Advisory Board on Mineral Development, Nova Scotia; executive secretary, Nova Scotia Centre for Geological Sciences; secretary, Associate Committee on Coal, Nova Scotia Foun-

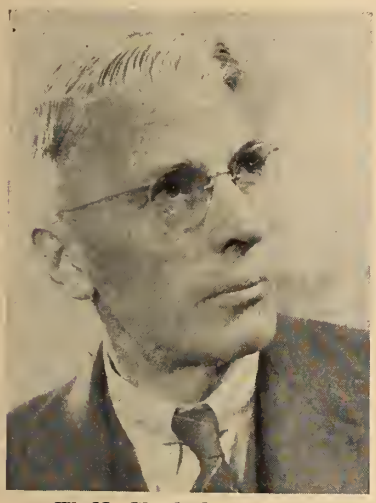
C. N. Murray, M.E.I.C.

dation; fellow, Geological Society of America. He became a Member of the Engineering Institute in 1943.

C. N. Murray, M.E.I.C., of Dominion Steel & Coal Corporation, Sydney, N.S., has been elected councillor of the Institute to represent the Cape Breton Branch.

Mr. Murray was born at Sydney, and attended Nova Scotia Technical College, graduating in 1935 in mechanical engineering. He has been with Dosco since his graduation, and is now the assistant to the general superintendent.

Mr. Murray, a member of the Association of Professional Engineers of Nova Scotia, became a member of the Institute in 1949. He is a past-councillor of the Association, and a past-chairman of the Cape Breton Branch of the Institute.



W. H. Chisholm, M.E.I.C.

W. H. Chisholm, M.E.I.C., of Dartmouth, N.S., district sales manager for Northern Electric Company Limited, Halifax, has been elected Councillor of the Institute to represent the Halifax Branch.

Mr. Chisholm was born in Halifax, and is a graduate of Nova Scotia Technical College, having received the degree of B.Sc. in mechanical engineering in 1916. He followed the Test Course of Canadian General Electric Company for a time, before going overseas during the First World War. He joined Northern Electric Company as a sales engineer in 1918. He became, subsequently, assistant sales manager and district sales manager.

He joined the Institute in 1942 as a Member. He has been active on the Halifax Branch, serving as chairman in 1950. He is a member, also, of the Association of Professional Engineers of Nova Scotia.

Hector Cimon, M.E.I.C., vice-president and secretary of Price Brothers & Company, Limited, in Quebec, has been elected a councillor of the Institute representing the Quebec Branch.

Mr. Cimon was born at Riviere du Loup, P.Q. He studied at Laval University where he received a B.A. degree in 1912, and at Ecole Polytechnique, Montreal, where he received the degree of B.A.Sc. in civil engineering in 1916.

Upon graduation he joined the engineering staff of Price Brothers & Company, Limited. He became secretary of the Company in 1939 and vice-president in 1946. At present he is secretary and vice-president in charge of properties and industrial relations.

He joined the Institute as a Student in 1912, becoming an Associate Member in 1919 and a Member in 1930. He has served the Quebec Branch as a secretary-treasurer from 1921 to 1923; as a councillor from 1924 to 1929; vice-chairman in 1930 and chairman from 1931 to 1934. He was councillor for the Quebec Branch in 1930-37 and later was vice-president of the Engineering Institute of Canada from 1942 to 1943.

Mr. Cimon is a member of the Corporation of Professional Engineers of Quebec and was a councillor of the Corporation during 1927 to 1940. He was also a representative of the Corporation on the Dominion Council of Professional Engineers for several years immediately after its organization.

N. B. Eagles, M.E.I.C., assistant city engineer of Moncton, N.B., will represent the Moncton Branch of the Council of the Institute.

Mr. Eagles graduated from the University of New Brunswick in 1935, with the degree of B.Sc. in electrical engineering. He served in the R.C.A.F. during the same year as a provisional pilot officer. In 1936 he became associated with the City of Moncton as assistant department head in the electrical department.

He obtained a leave-of-absence in 1941 to accept a position as instructor in the British Commonwealth Air Training Plan. After instructing for two years, he was appointed assistant chief

N. B. Eagles, M.E.I.C.

ground instructor at the Elementary Flying Training School at Neepawa, Manitoba.

In 1944 Mr. Eagles returned to his former position with the City of Moncton, and in 1947 was transferred to the city engineer's office as assistant to the city engineer. He was appointed street commissioner and assistant engineer in 1948. In 1949 he became a registered professional civil and electrical engineer in the Province of New Brunswick, and during that year he was promoted to the position of assistant city engineer for the City of Moncton.

Mr. Eagles has been active in engineering affairs. In 1951 he was elected to the council of The Association of Professional Engineers of the Province of New Brunswick for a 3 year term of office. During the past 5 years he has served on the executive of the Moncton Branch of the Institute. He was chairman of the Moncton Branch of the E.I.C. during 1950-51, and was appointed vice-president for New Brunswick, of the Maritime Branch of the American Waterworks Association for 1951. He had joined the Institute in 1935 as a Student, transferring to Junior in 1940 and to Member in 1942.

P. E. Kirkpatrick, M.E.I.C., of the Calgary Power Company, Lethbridge, has been elected the councillor of the Institute to represent the Lethbridge Branch.

Mr. Kirkpatrick was born at Canton, Ohio. He studied at Massachusetts Institute of Technology and at the U.S. Government Electrical School in Brooklyn, N.Y. He was with the 101st Signal Battalion, A.E.F., in 1917 to 1919, after which he was in Edmonton, Alberta, for three years, operating the city power house.

He did electrical contracting work in Calgary and Southern Alberta, from 1926 to 1930, and joined the Calgary Power Company then as an operating engineer. He was in Regina from 1936 to 1942, associated as operating superintendent with the Montreal Engineering Company. He went to Lethbridge for the Calgary Power Company in 1942.

Mr. Kirkpatrick joined the Institute as an Associate Member in 1938, transferring to Member in 1940. He was elected in 1951 as chairman of the Lethbridge Branch. He is an Associate Member of the American Institute of Electrical Engineers and a Member of Professional Engineers of Saskatchewan.

E. R. Smallhorn, M.E.I.C., general manager of Aerocrete Construction Co. Ltd., Montreal, has been elected a Councillor to represent the Montreal Branch of the Institute.

A Montrealer, he graduated from McGill University receiving a B.Sc. in civil engineering in 1923. On graduation he worked for the late H. G. Hunter, consulting engineer in Montreal, on water works and sewage work.

He left Mr. Hunter to accept a position as assistant to Mr. Willis Chipman, consulting engineer, Toronto, in connection with the design and construction of a filter plant, reservoir and other additions to the water system of the City of Welland, Ont. On the completion of this job, he came back to Montreal to accept a position with the firm of R. S. and W. S. Lea for whom he acted as

E. R. Smallhorn, M.E.I.C.

assistant engineer in connection with extensions to the water works systems at Windsor, Ont., and Brantford, Ont., and the power development on the Coaticook River for the Town of Coaticook, Que.

In 1931, he left Mr. Lea's employ to become associated with Aerocrete Construction Company Limited of which he is now general manager.

Mr. Smallhorn has been active in the Montreal Branch, having served it as secretary-treasurer, and as chairman. He joined the Institute as a Student in 1923, transferring to Associate Member in 1932, and to Member in 1940.

A. D. Ross, M.E.I.C., of Montreal, has been elected to the Council of the Institute to represent the Montreal Branch.

Mr. Ross is from Nova Scotia. He was educated at Pictou Academy, Dal-

A. D. Ross, M.E.I.C.

housie University, and Massachusetts Institute of Technology, where he received an M.Sc. degree in electrical engineering.

Joining the Canadian Expeditionary Force in 1914, he was on active service in France, after which he worked as a junior engineer with the General Electric Company in the United States, and with Canadian General Electric Company in Toronto.

Mr. Ross's construction experience began with Wayagamack Pulp and Paper Company and continued with Canadian Comstock Co., Limited. There he became manager, and later vice-president.

The firm, A. D. Ross & Company Limited, engineers and contractors, was formed in January, 1945, in Montreal.

Mr. Ross has been active in the Corporation of Professional Engineers of Quebec, of which he is a past councillor. He served the Corporation as secretary-treasurer in 1943-44. He joined the E.I.C. in 1926 as an Associate Member, transferring to Member in 1940.

D. Ross-Ross, M.E.I.C., has been re-elected to the Council of the Institute to represent the Cornwall Branch.

Mr. Ross-Ross is from Montreal, where he studied at Wyckem House, Macdonald College Day School, and McGill University, graduating in mechanical engineering in 1917.

He joined the Royal Canadian Navy that year, and after a year at sea was placed in charge of all engine room

D. Ross-Ross, M.E.I.C.

instructional work at H.M.C. Dockyard, Halifax, in June, 1918. He taught in Central Technical School, Toronto, for a time in 1919 before joining Dominion Rubber Company in 1920. He worked in the planning and in the engineering departments of the Company until 1925, when he went to the Howard Smith Paper Mills Limited, as a specialist on steam problems. He became chief industrial engineer in 1930 for the Howard Smith Paper Mills Ltd., and associated companies. He took charge of the cost department of the Company in 1931, and of the purchasing department six months later. During the war, on loan from his work, he performed numerous duties at Cornwall, and at its finish he resumed his duties as chief industrial engineer. He also took on some personnel work, and for several years has been chairman of the Personnel Committee of the Fine Paper Industry.

He has done consulting work in the past for Empire Cotton Mills Ltd., for Allied War Supplies Corporation, Canadian Car Munitions Ltd., and some other companies.

Mr. Ross-Ross has published approximately 15 papers on such subjects as industrial engineering, steam generation and consumption in the pulp and paper industry, maintenance cost control, and personnel work.

Mr. Ross-Ross was elected chairman of the Cornwall Branch at its inauguration in 1946. He joined the Institute as

B. G. Ballard, M.E.I.C.

a Student in 1916, transferring to Junior in 1918, to Associate Member in 1921, to Member in 1933. He has been on the Council since 1950, representing the Cornwall Branch.

B. G. Ballard, M.E.I.C., is the Councillor of the Institute representing the Ottawa Branch.

Mr. Ballard graduated in electrical engineering from Queen's University in 1924. He attended a graduate engineering course of Westinghouse Electric and Manufacturing Company in East Pittsburgh and in 1925 he entered the engineering department of that company, where he remained for the next five years. In 1930 he joined the National Research Council of Canada and assumed charge of the electrical engineering laboratory. In 1948 he was made director of the Radio and Electrical Engineering Division.

During the war Mr. Ballard's activities were devoted mainly to defence work and in particular to the development of mine sweepers for enemy magnetic mines and the protection of ships against these mines. In recognition of his contributions in this field, he was awarded the Order of the British Empire in 1946.

Mr. Ballard is past chairman of the Ottawa Branch of the Engineering Institute of Canada; a past chairman of the Ottawa Section of the American Institute of Electrical Engineers; a senior member of the Institute of Radio Engineers; and a member of the Association of Professional Engineers of the Province of Ontario and of the Professional Institute of the Civil Service of Canada. He joined the Engineering Institute in 1931 as an Associate Member, transferring to Member in 1940. He received the Ross Medal of the Institute in 1948 for his paper "Recent Canadian Radar".

A. R. Hailey, M.E.I.C., who is engineer in the motor and generator engineering division of Canadian General Electric

A. R. Hailey, M.E.I.C.

Company in Peterborough, Ont., has been elected Councillor of the Institute to represent the Peterborough Branch.

Born at Vancouver, B.C., Mr. Hailey attended the University of British Columbia, where he received a B.A.Sc. degree in electrical engineering in 1941. Upon graduation he accepted employment with Canadian General Electric in

Peterborough in the test course. In 1942 he was appointed a design engineer in what is now the motor and generator engineering division, Peterborough Works, and has since then been closely associated with the design of d-c rotating machinery and synchronous motors and generators. In his present position he devotes full time to d-c machinery design.

Mr. Hailey joined the Institute as a Junior in 1942, becoming a Member in 1949. He served as chairman of the Junior Section of the Peterborough Branch in 1943, and was secretary-treasurer of the Branch in 1946. Then in 1948 he was chairman of the meetings and papers committee, and the following year he was chairman of the Branch. He is also a secretary-treasurer for 1952 of the Canadian General Electric Test Alumni Association. He is a Member of the Association of Professional Engineers of Ontario.

Neil Metcalf, M.E.I.C., metallurgical engineer, Burlington Steel Co. Ltd., Hamilton, is the newly elected councillor representing the Hamilton Branch.

Born at Bury, Lancs, England, he received preliminary education there. Leaving school during the latter stages of World War I, he joined the Army and served with the B.E.F., being commissioned in the East Lancashire Regiment.

In 1919 he entered a training and apprenticeship course in the engineering shops and mills of the Ebbw Vale Steel Iron and Coal Co. Ltd., South Wales. During this time he was awarded a scholarship to the University College of

N. Metcalf, M.E.I.C.

South Wales and Monmouthshire, Cardiff, University of Wales. He graduated in 1925 with degree of B.Sc.

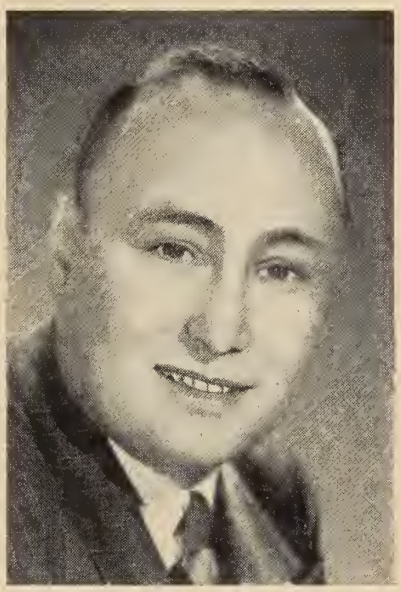
Subsequent connections in Great Britain were in the steel making department of Guest, Keen and Nettlefold, Cardiff, and the production and metallurgical departments of the Ford Motor Company, Manchester. He was appointed assistant metallurgist in 1926. A year later he went to Detroit, U.S.A., joining the Ford Motor Company in the open hearth steel plant.

In 1928 he was appointed chief metallurgist and melting superintendent for Treadwell Engineering Co., Easton, Pa. Through this period, his business and commercial education developed with courses at Columbia University, N.Y., and Alexander Hamilton Institute.

In 1936 Mr. Metcalf became associated with Burlington Steel Company in Canada.

He has been active in professional and technical organizations, and after several years on the executive was chairman of the Hamilton Branch of the Institute in 1949. He had joined the Institute in 1941. He also holds membership in the Association of Professional Engineers of Ontario; and the British Iron and Steel Institute. In the American Society for Testing Materials, he is presently councillor for the Western New York-Ontario District. He was chairman of the Ontario Chapter of the American Society for Metals in 1939.

Mortimer A. Montgomery, M.E.I.C., has been elected Councillor of the Institute to represent the Kitchener Branch.



M. A. Montgomery, M.E.I.C.

Mr. Montgomery who graduated from the University of Saskatchewan with a B.Sc. degree in mechanical engineering in 1934, is from Wapella, Sask. He worked on a geological survey of Northern Ontario in 1935. He was a sales engineer for Sarco Canada Ltd., Toronto, from 1935 to 1937.

He joined the Canadian Blower and Forge Company Limited sales staff in 1937 in the Montreal District. From 1942 to 1945 he served as an engineer officer in the Royal Canadian Navy, Construction Directorate. Returning to Canadian Blower and Forge Company Limited, he moved to Kitchener where he held the position as assistant sales manager for engineering products. He was appointed sales manager in August, 1951, and in January, 1952, he was appointed to the board of directors of the Company.

He has been actively associated with the Engineering Institute, having been appointed the first chairman of the Kitchener Branch, on its inauguration in 1950. He is also a member of the Kitchener Chamber of Commerce, the Association of Professional Engineers of Ontario, and the Gyro Club.

P. E. Buss, M.E.I.C., of Thorold, Ontario, has been re-elected to represent the

P. E. Buss, M.E.I.C.

Niagara Peninsula Branch on the Council of the Institute.

Born at Three Rivers, Mich., he received his engineering education at the University of Michigan. During World War I, he served with the United States Army Engineers in France. Mr. Buss was employed on the engineering staff of Provincial Paper Limited on construction of the first sulphate plant at the head of the lakes at Port Arthur, Ont. He later worked on the engineering staff of Dominion Engineering Works, and for a number of years was plant engineer at the Thorold division of Provincial Paper Limited. During 1932-33 he and his brothers carried on experiments in developing the new process for producing rock wool by the spinning method. He is now president of Spun Rock Wools Limited at Thorold.

Mr. Buss joined the Institute as an Associate Member in 1927 becoming a Member in 1940. He served as secretary-treasurer of the Niagara Peninsula Branch in 1931, and as chairman in 1935. He has served as councillor for the Niagara Peninsula Branch continuously since 1946.

Edwin W. Dill, M.E.I.C., of Polymer Corporation Limited, has been elected councillor of the Sarnia Branch of the Institute.

Mr. Dill graduated in mechanical engineering with the degree of B.A.Sc. from the University of Toronto, class

E. W. Dill, M.E.I.C.

of 1928. In the early years of the war, he was engaged on general plant engineering with the Welland Chemical Works, an important explosives manufacturing plant in the Niagara Falls area. He left there in 1942 to work on the design of the steam and power plant for Canada's new synthetic rubber industry, in the office of the designers, H. G. Acres and Company. Upon the completion of construction he assumed the position of superintendent, which position he still holds. Up until the time the second boiler at the R. L. Hearn steam power station went into operation in Toronto, this Spring, the Polymer steam plant was unique in that it was the largest single producer of steam in Canada.

He was one of a committee of three appointed to inquire into the feasibility of forming a branch in Sarnia of the Engineering Institute; and he is a Charter Member of the Sarnia Branch which was formed subsequently, serving on the executive for several years and as vice-chairman. He joined the Institute in 1929 as a Student, transferring to Associate Member in 1938, and to Member in 1940.

J. J. Hanna, M.E.I.C., will represent the Calgary Branch on the Council of the Institute.

Mr. Hanna is from Toronto. He was

J. J. Hanna, M.E.I.C.

educated in Toronto and Calgary public and high schools; and from the University of Toronto he received the degree of B.A.Sc. in 1914.

Serving with the Canadian Expeditionary Force from 1914 to 1919, in the First Field Company, the Third Tunnelling Company and the 9th Battalion, Canadian engineers, he received a commission in France in 1916, and was promoted to captain in 1918.

He had worked with the City of Calgary Engineering Department before going overseas, and he returned to the Department in 1919 and was engaged for two years in reinforced concrete and bridge construction. In 1921-22 he worked as resident engineer on the Old Man River crossing for the Lethbridge Northern Irrigation District.

Joining Imperial Oil Ltd., at the Calgary Refinery in 1922, he has remained with the Company, and has worked as construction engineer, refinery engineer, assistant superintendent; and since 1948 he has been superintendent.

Mr. Hanna joined the Institute in 1917 as an Associate Member, transferring to Member in 1940. He was chairman of the Calgary Branch in 1949-50. He has also been active in the Association of Professional Engineers of Alberta, serving as a Councillor in 1950-1952.

T. E. Storey, M.E.I.C., assistant general manager of the City of Winnipeg Hydro-Electric System, has been elect-

T. E. Storey, M.E.I.C.

ed Councillor of the Institute representing the Winnipeg Branch.

Mr. Storey is from Brockville, Ontario. He graduated from the University of Manitoba with a degree of B.Sc. in electrical engineering in 1928. He was with Canadian General Electric Company test course and engineering office for a year.

Mr. Storey joined the staff of the Winnipeg Hydro-Electric System in 1929 as design engineer. From 1935 he was chief operator at Slave Falls Power Plant until 1940, when he was transferred to the Engineering Department at the head office as operating engineer. In 1944 he was appointed general superintendent in charge of production, and became chief engineer in 1948. His appointment as assistant general manager was received earlier this year.

Mr. Storey joined the Institute as a Student in 1926. In 1933 he was transferred to Junior and two years later to Associate Member. He became a Member in 1940. He was the chairman of the Winnipeg Branch in 1947.

D. C. Holgate, M.E.I.C.

D. C. Holgate, M.E.I.C., has been elected Councillor of the Institute to represent the Sault Ste. Marie Branch.

Mr. Holgate was born in Montreal. He received the degree of B.A. in mathematics from Acadia University in 1935, and that of B.Eng. in civil engineering from McGill University in 1938.

Joining the staff of Dominion Bridge Company Limited in Toronto in 1939, he was transferred as engineer to the Sault Structural Steel Company Limited in Sault Ste. Marie in 1941.

Entering the E.I.C. as a Junior in 1942, he was transferred to Member in 1947. He served as secretary-treasurer of Sault Ste. Marie Branch in 1947, and chairman in 1949. He is also a member of the Association of Professional Engineers of Ontario.

C. D. Carruthers, M.E.I.C., who is general manager and designing engineer of Wallace, Carruthers & Associates Ltd., in Toronto, Ont., has been elected a Councillor of the Institute representing the Toronto Branch.

Born at Millbrook, Ont., he studied at the University of Toronto where he received a B.A.Sc. degree in 1927. After graduation he joined Gordon L. Wallace, M.E.I.C., consulting engineer, as designer and draughtsman.

Mr. Carruthers remained with Gordon L. Wallace and received, in 1931,

C. D. Carruthers, M.E.I.C.

an appointment as chief designer. He was consulting structural engineer for the firm prior to his appointment as associate and chief designer in 1947. The firm became known as Wallace, Carruthers & Associates Ltd., in 1951.

He joined the Institute as a Student in 1927, transferring to Junior in 1929. He became an Associate Member in 1935 and a Member in 1940. He was chairman of the Toronto Branch in 1951.

Sidney Hogg, M.E.I.C., will represent the Vancouver Branch on the Council of the Institute.

Mr. Hogg, president and managing director of Western Bridge & Steel Fabricators, Ltd., and vice-president of Morrison Steel & Wire (1950) Ltd., was born in Dundee, Scotland.

He was educated at Dundee Technical College, and received the degree as a naval architect in 1922. He commenced his career with the Dundee Shipbuilding

S. Hogg, M.E.I.C.

Company in 1916 and he came to Canada in 1923 as design engineer with Canadian Vickers, Montreal. He was the engineer-in-charge of structural design, and later superintendent of ship construction, St. John Drydocks, Saint John, N.B., from 1928 to 1944.

Mr. Hogg joined his present Company in Vancouver as chief engineer in 1944. He was sucessively sales manager and general manager; and he was appointed managing director in February 1950, and president and managing director in October 1950.

Mr. Hogg is a past chairman of the Vancouver Branch of the Institute. He joined the Institute in 1931, as an Associate Member, transferring to a Member in 1940. He is affiliated, also, with the Association of Professional Engineers of British Columbia, the Vancouver Board of Trade, and the Canadian Manufacturers Association.

Personals

News of the Personal Activities of Members of the Institute

S. L. Baird, M.E.I.C., research and development engineer with the Consolidated Mining and Smelting Company, has been elected to serve as chairman of the Kooteney Branch of the Institute.

Mr. Baird has been with this company since 1947 when he joined as assistant to the senior research engineer, becoming research and development engineer in 1949. During the war he served in the Royal Canadian Navy from 1940 to 1945 as Lieutenant Commander and was mentioned in dispatches.

He graduated in chemical engineering from McGill University in 1946.

S. L. Baird, M.E.I.C.

T. Foulkes, M.E.I.C., steam and power engineer for E. B. Eddy Company has been elected to serve as chairman of the Ottawa Branch of the Institute.

After graduating in electrical engin-

T. Foulkes, M.E.I.C.

eering from the University of New Brunswick in 1926, Mr. Foulkes joined the Canadian General Electric Company on a test course and in the design offices. From 1928 he worked for 10 years with the Spruce Falls Power and Paper Company in various capacities in the mechanical and electrical departments. In 1938 he joined J. R. Booth Limited and at the time of the amalgamation with the E. B. Eddy Company in 1945, he was employed as plant engineer.

He is at present in charge of production and distribution of electrical power and steam, and maintenance of electrical equipment.

I. R. Tait, M.E.I.C., is relinquishing his position as chief engineer of the Engineering Department of Canadian Industries Limited, but at the request of that Company, will continue to serve in the capacity of consulting engineer.

Mr. Tait joined the C.I.L. in 1915 as an electrical engineer and subsequently became assistant chief engineer in 1929, and chief engineer in 1939.

Mr. Tait is affiliated with the Association of Professional Engineers of Ontario, Manitoba, British Columbia, and with the Corporation of Professional Engineers of Quebec. He is a member of the American Society for Testing Materials, the Electrochemical Society and the National Fire Protection Association.

He is past chairman of the Montreal Branch of the Institute and has served on the Institute's Finance Committee and on the Committee on Employment Conditions. He is also a member of the Metropolitan Board of Directors of the Montreal Y.M.C.A.

G. Demers, M.E.I.C.

G. Demers, M.E.I.C., consulting engineer of Quebec, has been appointed to serve as chairman of the Quebec Branch of the Institute.

Mr. Demers graduated in civil engineering with a B.A.Sc. degree in 1935 and worked for a time with the Roads Department of the Province of Quebec, first as resident engineer and then as division engineer at Carlton, Quebec. In 1939 he took charge of the office of Zachee Langlais, consulting engineer, in Quebec.

C. L. Fisher, M.E.I.C., of Armco Drainage and Metal Products of Canada Limited, has been appointed to serve as chairman

C. L. Fisher, M.E.I.C.

of the Winnipeg Branch of the Institute.

Mr. Fisher is the engineer for Western Canada for his company; he is a member of the Association of Professional Engineers of Manitoba and he graduated in civil engineering from the University of Manitoba in 1930.

W. J. W. Reid, M.E.I.C., has been appointed director of the Gun Division, Production Branch of the Department of Defence Production.

W. J. W. Reid, M.E.I.C.

Mr. Reid, president of the Otis Elevator Company Limited at Hamilton, Ont., is on temporary loan to the Department. He has been associated with the Otis Elevator Company since 1921 and has held a number of important positions with that Company. In 1941 he was appointed manager of munitions in charge of the Company's war production and under his direction thousands of Bofors guns were produced in addition to a large volume of other war materials.

Mr. Reid graduated in electrical engineering from the University of Toronto in 1924; he served with the Royal Canadian Engineers in World War I.

Among other offices, he has been a vice-president of the Institute and president of the Association of Professional Engineers of the Province of Ontario.

R. A. C. Henry, C.M.G., M.E.I.C., executive vice-president and director of Marine Industries Limited has been appointed head of a five-man board of engineers in Montreal appointed by the Federal Government, Quebec and Ontario to further the power development phases of the all-Canadian St. Lawrence seaway project and to co-ordinate development of the International Rapids.

Mr. Henry was elected to the board of directors of Marine Industries Ltd., in 1949; he is also associated with Sorel Industries Ltd., and other companies of the Marine Industries group.

In 1944 he was named chairman, for a period of 10 years, of the Canadian Air Transport Board.

Mr. Henry has had a sound background of engineering experience which culminated in administrative positions such as those of vice-president and general manager of Beauharnois Light, Heat and Power Company and Montreal Light, Heat and Power Consolidated. His experience in Government work includes service as an engineer in the former Department of Railways and Canals of which he was, at one time, deputy minister. For 6 years he was director of the Bureau of Economics of Canadian National Railways. During the war he served as executive assistant to the Minister of Transport and later as economics adviser to the Department of Munitions and Supply. In 1943 he was appointed president of Defence Communications Ltd., a Crown Co., established to co-ordinate certain telegraph, telephone and other communication systems in Canada on behalf of the armed forces.

Mr. Henry is a graduate of McGill University; he became a Life Member of the Institute in 1949.

J. A. Walker, M.E.I.C., and **A. G. Graham,** M.E.I.C., have entered partnership under the name of Walker and Graham as a consulting service to municipal, private and public agencies for community and regional development problems at Vancouver, B.C.

Mr. Walker has been working with the Vancouver Town Planning Commission since 1944 and previously was a mechanical engineer with the Department of National Defence in Ottawa. He is a graduate from the University of Toronto.

Mr. Graham has been division engineer on the construction of the Pacific Great Eastern Railway between Quesnel and Prince George, B.C., since 1949; earlier he was director of the Regional Planning Division with the Department of Municipal Affairs, British Columbia Government.

Mr. Graham was educated at the Royal Technical College in Glasgow, Scotland.

W. H. Wharton, M.E.I.C., who relinquished his position as chief engineer of the Howard Smith Paper Mills Limited, on account of ill-health, has made good recovery and is acting in a consulting and advisory capacity in connection with the Company's engineering program at Montreal, Que.

W. H. Wharton, M.E.I.C.

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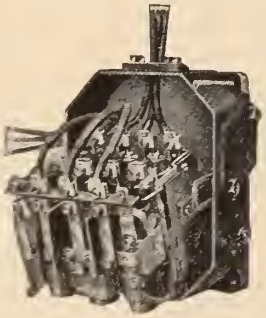

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Mr. Wharton has been chief engineer since 1947; previously he was chief engineer with the Allied War Supplies Corporation at Montreal.

Lt. Col. A. L. Mieville, D.S.O., M.C., M.E.I.C., managing director of the associated companies throughout Asia of John Blackwood Hodge & Company Limited, who went to Calcutta, India in 1951, is now with the Company Office in London, England.

In 1946 Mr. Mieville was managing director of Bailimo Limited of London, England, and earlier worked with the British Ministry of Supply Mission in Washington, D.C. In 1940 he was with the Ministry of Labour and National Service in London, after acting as purchasing agent for Switchgear and Cowans Ltd., in Manchester, since 1937.

E. Chorolsky, M.E.I.C., is taking an appointment as chief plant engineer for Ford Motor Company of Australia (Pty) Ltd., at Victoria, Australia; this assignment involves a major expansion program to increase the Ford Motor Co. facilities for manufacture and assembly of a wide range of vehicles at Geelong, Sydney, Brisbane, Adelaide, and Freemantle.

Mr. Chorolsky joined Ford of Canada in 1937 when Plant 4 was under construction; he was transferred to the Foundry division making layout and equipment designs during the war. In 1946 he went to South Africa as project engineer on the new Ford-South Africa plant at Port Elizabeth, and returned to Windsor, Ont., in 1929, when he was appointed assistant plant engineer in charge of plant engineering and design unit of plant engineering and maintenance sub-division.

Before joining Ford Company he was with the Canadian Bridge Company for 10 years.

Mr. Chorolsky graduated in civil engineering from the University of Toronto in 1926 with a B.A.Sc. degree; he is a member of the Association of Professional Engineers of Ontario.

J. L. Delisle M.E.I.C., and **Maurice Laquerre** M.E.I.C., have formed a partnership as consulting engineers under the name Delisle and Laquerre, at Chicoutimi, P.Q.

Mr. Laquerre associated himself with Lavoie and Delisle, consulting engineers, in 1946. Previously, he was with the Aluminum Company at Arvida, Que., and earlier he had been field engineer with Angus Robertson Limited, Montreal, since 1942. He graduated in civil engineering with a B.A.Sc. degree from the Ecole Polytechnique in 1942.

Mr. Delisle had been a partner of Lavoie and Delisle since 1930. Previously, he was mechanical and electrical superintendent with the Chicoutimi Pulp Company, Chicoutimi, Que. He graduated in civil engineering with a B.A.Sc. degree from the University of Toronto in 1916.

J. Alton, M.E.I.C., has recently been appointed chief engineer with the Department of Public Works, at Victoria, B.C., after serving as designing engineer for five years.

Previously he had been with the Canadian Bridge Company at Windsor, Ont., for eight years.

Mr. Alton studied at the New Zealand University Engineering College, the Woolwich Polytechnic, England, and the Regent St. Polytechnic, London, England.

G. E. Ransom, M.E.I.C., design engineer with the Quebec Hydro-Electric Commission has been transferred from the Power Development Division at Beauharnois, Que., to Montreal, Que.

Previously he was with the Beauharnois Light, Heat and Power Company, Beauharnois, Que.

Mr. Ransom graduated in electrical engineering from McGill University in 1943.

H. F. Abbott, M.E.I.C., is with the Quebec Hydro-Electric Commission in Montreal, working in the Power Development Division.

Previously, Mr. Abbott had been assistant plant superintendent of the Beauharnois Light, Heat and Power Co., at Beauharnois, Que., since 1936. Earlier he worked with the Canadian National Railways, Montreal.

Mr. Abbott graduated in electrical engineering from McGill University in 1928.

J. Ivor Strong, M.E.I.C., of Calgary, Alta., has been appointed city commissioner in charge of engineering and public utilities. Mr. Strong, the former city engineer of Calgary, is to take the new post in January, 1953.

He studied at University of Saskatchewan, graduating as a civil engineer in 1929. He worked for a firm of consulting municipal engineers, and was town engineer at Estevan, Sask., from 1931 to 1932.

He went to Weyburn as engineer, and six years later joined the P.F.R.A. during which time he was in charge of a Federal water supply project for Moose Jaw. He was later city engineer at Swift Current, and in 1944 went to Calgary as assistant engineer. Four years later he became city engineer.

James Breakey, M.E.I.C., is with Imperial Oil Limited at St. John's, Newfoundland. Mr. Breakey has been with Imperial Oil Limited at Cobourg, Ont., since 1940 and was previously in the industrial sales department in Toronto.

Mr. Breakey came to Canada in 1929 as a draughtsman with Canadian Vickers Ltd., and later became associated with the McLean Publishing Company until he joined Imperial Oil Ltd., in 1939. He was educated at Sheffield University in England, served his apprenticeship with Metropolitan Vickers Limited at Manchester and remained with this firm until 1927, when he served for two years as a sea-going engineer with A. Holt and Company, owners of the Blue Funnel Line.

B. W. Burgess, M.E.I.C., has been appointed assistant to the president of the Pulp and Paper Research Institute of Canada at Montreal. Previously, Mr. Burgess was technical assistant to the executive secretary of the Technical Section, of the Canadian Pulp and Paper Association, Montreal.

Mr. Burgess graduated in chemical engineering from Queen's University in 1944 and received his Master's degree in 1946.

W L. Dickson, M.E.I.C., has left The Deloro Smelting and Refining Company Limited at Deloro, Ont., and has taken the position of maintenance manager of

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the Victoria General Hospital at Halifax, N.S.

Mr. Dickson had been assistant chief engineer with The Deloro Company since 1929; he graduated in electrical engineering from Nova Scotia Technical College in 1929 and in mechanical engineering from McGill University in 1940.

H. J. McEwen, M.E.I.C., is with Canadian Westinghouse Company Limited at Calgary, Alberta, as special representative for the western region. He has been branch manager for this Company since 1931.

Mr. McEwen graduated in electrical engineering with a B.A.Sc. degree from the University of Toronto in 1912.

G. H. Heyn, M.E.I.C., is with the Brompton Pulp and Paper Company Limited at Red Rock, Ont. Since 1951, Mr. Heyn has been in private practice as a consulting engineer in Toronto, Ont.

C. G. Kingsmill, M.E.I.C., has joined Angus Robertson Limited at Montreal, Que. Previously, Mr. Kingsmill held the position of chief engineer of the Power Development Division of the Quebec Hydro-Electric Commission which was set up in 1951 to take over the designing and construction activities of power development.

He graduated in mechanical engineering with a B.A.Sc. degree from the University of Toronto in 1924.

T. H. Henry, M.E.I.C., is with Sprostons Ltd., at Kingston, Jamaica, B.W.I.

Mr. Henry graduated from McGill in 1914 and served overseas in the armed forces during World War I. After 1919, he worked for a time with the Canadian Pacific Railways and later with T. Pringle and Company, Montreal; subsequently he became connected as superintendent with many large construction projects with various contractors. In 1940, he went to Georgetown, British Guiana, S.A., with the Demerara Bauxite Company, and since 1949 has been in French Guinea, West Africa.

J. G. MacGregor, M.E.I.C., of Edmonton, Alta., has been appointed chairman of the reorganized Alberta Power Commission, in charge of the compiling of an over-all inventory of facilities for generating, transmitting and distributing power in that province.

Mr. MacGregor, the former general manager of Canadian Utilities Ltd., was associated with that firm since his graduation from University of Alberta in 1929. He worked in Calgary until 1931, and later at Vegreville, going to the Edmonton Office in 1948. He is a past-chairman of the Calgary Branch of the Institute, and a past councillor of the Institute, representing the Calgary Branch.

J. G. MacGregor, M.E.I.C.

D. H. Rochester, M.E.I.C., has recently joined the Canadian Army Staff College at Kingston, Ontario, with the rank of Lieutenant-Colonel.

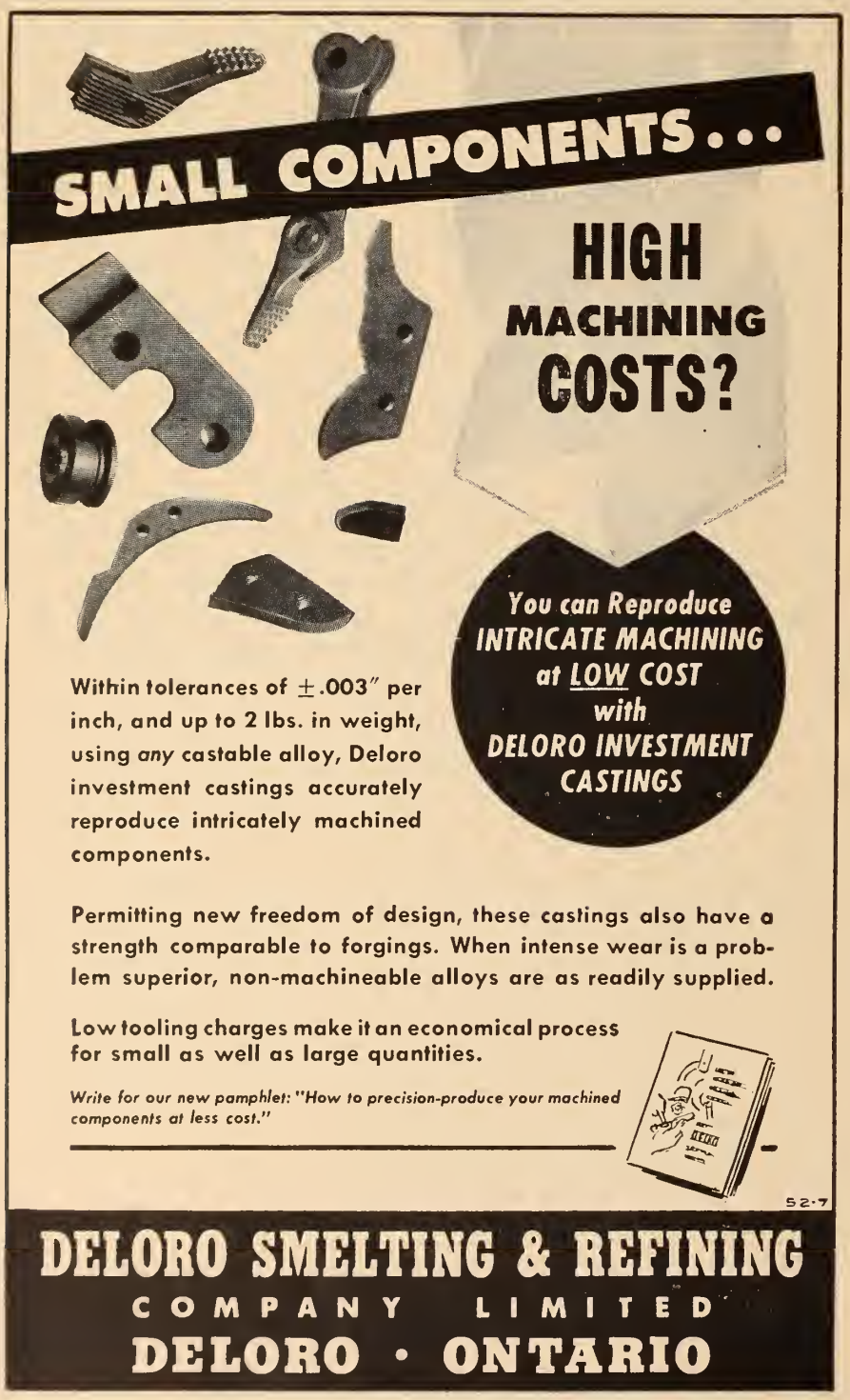
Previously, he held the rank of major as chief instructor at the Royal Canadian School of Military Engineering at Chilliwack, B.C., since 1949; in 1947 he was general staff officer at Army Headquarters at Ottawa, Ont., after attending the Staff College of Canada at the Royal Military College at Kingston, Ont.

He graduated in mining engineering with a B.A.Sc. degree from the University of Toronto in 1941.

F. C. Richardson, M.E.I.C., has joined the Canadian General Electric Company at Toronto, Ont.

Mr. Richardson had been assistant manager of the Standard Chemical Company Limited at South River, Ont., since 1949, and previously, was foundry superintendent for Mueller Limited at Sarnia, Ont., since 1947. In 1944 he was with the General Technical Department of the Aluminum Company of Canada Limited at Shawinigan Falls, Que.

He graduated from the University of Toronto in chemical and metallurgical engineering in 1935.



A. R. Moffat, M.E.I.C., is with H. G. Acres and Company, consulting engineers at London, Ont. Since 1951, Mr. Moffat had been working on transmission line construction at Niagara Falls, Ont.; he has been with this Company since 1947.

Previously, he had worked with the Department of Mines and Resources at Ottawa, Ont., and the Hydro-Electric Power Commission at Arnprior, Ont.

During the war, he was in the Works and Buildings Branch of the Naval Service in New Brunswick and with the Department of National Defence at Halifax, Nova Scotia.

Norman Wagner, M.E.I.C., is in private practice as a consulting engineer at Hamilton, Ontario.

Previously, he was a partner of Wagner and Oliver at Hamilton, Ontario.

Mr. Wagner has had many years as a consulting structural engineer in Ontario. He was a graduate in civil engineering from the University of Toronto in 1910.

A. E. Tyson, M.E.I.C., has left the Iron Ore Company of Canada at Mont Joli, Que., and is in private practice as a mining engineer at Guelph, Ont.

Previously, he was a construction engineer with the Quebec North Shore and Labrador Railway Company at Mont Joli, Que.

Mr. Tyson graduated with a B.A.Sc. degree from the University of Toronto in 1931.

K. W. Schoeneich, M.E.I.C., is employed with the Hydro-Electric Power Commission of Ontario at Toronto, Ont. Previously, he was with the Power Corporation of Canada an affiliated Company of Southern Canada Power Company Ltd.

Mr. Schoeneich graduated in electrical engineering from the Polytechnic Institute of Warsaw in 1932.

B. H. Schroter, M.E.I.C., of Schroter Bros. Limited, is now a citizen of Vancouver, B.C. Mr. Schroter has been a partner in the firm of Schroter Bros. Ltd., since 1946; previously, he served with the R.C.A.F. at P.E.I.

He is a graduate in electrical engineering from the University of Hong Kong where he obtained his B.A.Sc. degree in 1930.

B. P. Scull, M.E.I.C., has been transferred from the Technical Information Service of the National Research Council at Ottawa, to the Division of Building Research.

Mr. Scull had been officer in charge of the Technical Information Service since 1948. In 1945 he was with the Department of Reconstruction and Supply at Ottawa and previously, he was with the Saskatchewan Government Water Rights Branch at Regina, Sask.

He graduated from the University of Saskatchewan in 1929.

Lt.-Col. G. P. Stirrett, O.B.E., M.E.I.C., has been elected to the presidency of the Red Cross Association, British Columbia Division.

Since 1946, he had been president of the General Appraisal Company Limited at Vancouver, B.C.

In 1940, he was with the War Supply Board at Vancouver and later served with the R.C.E. with the rank of major. He returned from overseas service in 1944 with the rank of Lieutenant-Colonel, having also received the award of O.B.E. in 1943.

D. H. Lynch, M.E.I.C., who is with the Quebec Iron and Titannium Corporation has been transferred from Montreal to Havre St. Pierre, Que.

Mr. Lynch graduated from the University of New Brunswick in 1936.

H. C. Karn, M.E.I.C., Power Engineering Supervisor of Canadian Industries Limited at Montreal, Que., has recently been elected president of the Montreal Branch, University of Toronto Alumni; he is also third vice-president and out-of-town representative of the Engineering Alumni Association.

Other Alumni officers elected are: W. W. Timmins, M.E.I.C., 1st vice-president; A. R. Colman, M.E.I.C., 2nd vice-president; C. A. Parkinson, secretary; G. B. Lint, assistant secretary; T. W. Proctor, treasurer; J. T. Brennan, M.E.I.C., assistant treasurer; T. A. Legge, chairman, working committee; H. K. Armstrong, assistant chairman, working committee.

C. E. Campeau, M.E.I.C., master planning engineer City of Montreal, Planning Department, has been elected President of the Quebec Provincial Division of the Community Planning Association of Canada.

Mr. Campeau has been with the Planning Department of the City of Montreal since 1945; he is a graduate of the Ecole Polytechnique where he received his B.A.Sc degree in civil engineering in 1941.

Dr. D. J. MacNeil, M.E.I.C., Professor of Geology at St. Francis Xavier University, Antigonish, Nova Scotia, has been

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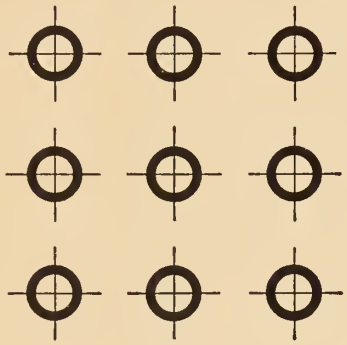

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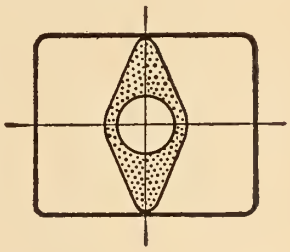

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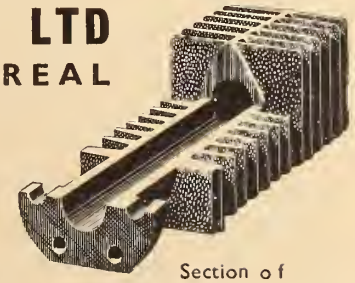

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elected president of the Association of Professional Engineers of Nova Scotia.

Dr. MacNeil's career is described more fully in another section of this issue announcing the new officers of the Association.

G. J. Currie, M.E.I.C., senior civil and hydraulic engineer with the Nova Scotia Light and Power Company Limited at Halifax, has been elected vice-president of the Association of Professional Engineers of Nova Scotia.

Mr. Currie has been with the Nova Scotia Light and Power Co. Ltd., since 1935; he graduated from the Nova Scotia Technical College in 1931.

H. H. Angus, M.E.I.C., president of H. H. Angus and Associates Limited of Toronto, Ontario, has been elected Dominion President of the Association of Consulting Engineers of Canada.

Mr. Angus' long experience as a consulting engineer has been connected with the design and installation of mechanical equipment, electrical, ventilation, plumbing, and power plants for a number of public buildings throughout Ontario.

J. Haliburton, M.E.I.C., has been transferred by Imperial Oil Limited, from Sarnia to the Producing Department of the General Engineering Division at Calgary, Alberta.

Mr. Haliburton has been with Imperial Oil Limited since 1950 when he joined as junior engineer in the Production Control Group.

He graduated in chemical engineering from Queen's University in 1943 and obtained his Master's degree from the University of British Columbia in 1947.

W. J. Keough, Jr.E.I.C., has been transferred by Imperial Oil Limited from Sarnia to Regina, Saskatchewan.

Mr. Keough graduated in mechanical engineering from Queen's University in 1948.

W. B. Maxwell, Jr.E.I.C., has been transferred by Imperial Oil Limited from Sarnia to Toronto, Ontario, as process design engineer.

Mr. Maxwell graduated with a B.A.Sc. degree in chemical engineering from the University of Toronto in 1950.

F. S. Flewelling, Jr.E.I.C., is working with the Iron Ore Company of Canada at Mont Joli, Que.

Mr. Flewelling graduated in civil engineering from Queen's University in 1950.

Pierre-Paul Arbic, Jr.E.I.C., has joined J. P. Morin Reg'd., general contractors, at Cap-de-la-Madeleine, P.Q.

Previously, Mr. Arbic was with Collett Freres Ltee, at Sudbury, Ontario.

He graduated in civil engineering from Ecole Polytechnique in 1948.

D. R. Abbey, Jr.E..IC., has joined Stone and Webster (Canada) Limited of Toronto, Ont., and is employed on the Canadian Oil Refineries project, at Froomfield, Ont.

Previously, he was a field office manager in the resident engineer's office at Senneterre, Que., for Surveyor, Nenniger and Chenevert, Montreal.

Mr. Abbey graduated from the University of Saskatchewan in 1945 and did post-graduate work at McGill University.

D. L. Allen, Jr.E.I.C., has left the Montreal East Refinery of the Shell Oil Company of Canada to join the National Petro-Chemicals Corporation in New York City.

Mr. Allen graduated with a B.A.Sc. degree in chemical engineering from the University of Toronto in 1950.

S. Gauly, Jr.E.I.C., is a liaison engineer with Canadair Limited at Ville St. Laurent, Que. He had been working in the construction department of the Ontario Hydro at Toronto since he graduated in mechanical engineering from the University of Saskatchewan in 1950.

R. D. Dunlop, Jr.E.I.C., has joined the B.C. Forest Products at Britain River, Jervis Inlet, B.C.

Mr. Dunlop graduated in forestry engineering from the University of British Columbia in 1949.

C. K. Earle, Jr.E.I.C., is working with the Hamilton Hydro Electric System, at Hamilton, Ont.

Mr. Earle graduated from the University of New Brunswick in 1950.

A. Estrin, Jr.E.I.C., is in training with the English Electric Company at St. Catharines, Ont.

Previously he had been a trainee at Halliburton Oil Well Cementing Company at Edmonton, Alberta.

Mr. Estrin graduated in electrical engineering from the University of Alberta in 1950.

A. L. Court, Jr.E.I.C., is a junior mechanical engineer for the Canadian Pacific Railway Company at Montreal.

Mr. Court graduated in mechanical engineering from the University of Saskatchewan in 1950 and worked for a year in the building department of the City Hall at Regina, Saskatchewan.

J. A. Everts, Jr.E.I.C., has recently joined the Foundation Company of Canada as a field engineer at Sudbury, Ont.

Mr. Everts graduated in civil engin-

★

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eering from the University of Manitoba in 1950.

H. K. Larsen, JT.E.I.C., has been transferred from Moncton to Cornwall, Ont., by E. G. M. Cape and Company to act as assistant superintendent on the contract for the extension to the Courtaulds Rayon Mills, and the building of a new plant for T.C.F. Canada, Limited.

In Moncton, he was a construction engineer on the extension to the Dominion Government Building. Previously Mr. Larsen was employed by T. Pringle and Son working in Montreal and Three Rivers and also by the Fluor Corporation of Los Angeles and the Dominion Bridge Company Limited at Montreal.

He graduated from the University of New Brunswick in civil engineering in 1949.

G. N. Bennett, JT.E.I.C., is being transferred to Winnipeg by General Diesel Motors Limited, to represent them as service engineer for Western Canada.

Mr. Bennett joined General Motors Diesel Limited in 1950 after graduating in electrical engineering from the University of Manitoba and has been working in London, Ontario.

S. H. Brown, JT.E.I.C., is working in the design office at A. V. Roe, Canada, Limited at Weston, Ontario, on electrical installations in the jet aircraft field.

Mr. Brown graduated in electrical engineering from the University of Manitoba in 1950.

Claude Belleau, JTE.I.C., is working in the engineering department of the Aerocrete Construction Company, at Montreal, Que.

Mr. Belleau graduated in civil engineering with a B.A.Sc. degree from Ecole Polytechnique in 1950 and obtained a M.A.Sc. degree in metallurgical engineering in 1951.

W. Cooper, JT.E.I.C., is working as an electrical and instrument engineer with the National Research Council at Chalk River, Ont.

Previously, he was with Halross Instruments Corporation in Manitoba.

Mr. Cooper graduated in electrical engineering from the University of Manitoba in 1950.

E. J. Connor, JT.E.I.C., has left Imperial Oil Limited at Redwater, Alberta to join Western Leaseholds Limited at Calgary, Alta. Mr. Connor had been with Imperial Oil Limited in the capacity of drilling engineer since 1950. Previously, he spent four years in Columbia, Equador and Peru with the International Petroleum Company. While in South America he served in the positions of mud engineer, drilling engineer, reconditioning engineer and acting district petroleum engineer.

He graduated in chemical engineering from Queen's University in 1944.

H. V. Chapman, JT.E.I.C., is working with Campbell Electrical Limited at Brantford, Ontario.

Mr. Chapman graduated in electrical engineering from the University of New Brunswick in 1950.

J. M. Cameron, JTE.I.C., is working with Imperial Oil Limited at the Montreal East Refinery.

Mr. Cameron graduated in mechanical engineering from Mount Allison University and Queen's University in 1947.

N. E. Hudak, JT.E.I.C., has moved from Vancouver, B.C., to Hamilton, Ontario, and is working with Canadian Westinghouse Company Limited.

Previously, he was an instructor in electrical engineering at the University of British Columbia.

Mr. Hudak graduated in electrical engineering with a B.A.Sc. Honours degree from the University of British Columbia in 1948, and received his Master's degree in 1951.

E. N. Kolbeins, JT.E.I.C., has joined the electrical staff of Associated Consulting Engineers in Vancouver, B.C. Previously he was with A. T. Simpson, consulting engineer of Vancouver, B.C.

Mr. Kolbeins graduated in electrical engineering from the University of British Columbia in 1950.

Major R. W. Potts, D.S.O., JT.E.I.C., is with the R.C.E. in Germany. Until recently he has been stationed at Whitehorse, Y.T., as a bridge engineer.

Major Potts graduated in civil engineering from the University of Saskatchewan in 1947.

J. H. Wright, JT.E.I.C., is with the Shell Chemical Corporation in New York, U.S.A.

Mr. Wright graduated in mechanical engineering with an Honours degree from McGill University in 1949 and was awarded a Shell Fellowship for postgraduate study at the University of California.

R. A. Stewart, JT.E.I.C., is an engineer with the Department of Mines and Technical Surveys at Ottawa, Ont.

Mr. Stewart graduated in civil engineering from the University of New Brunswick in 1950.

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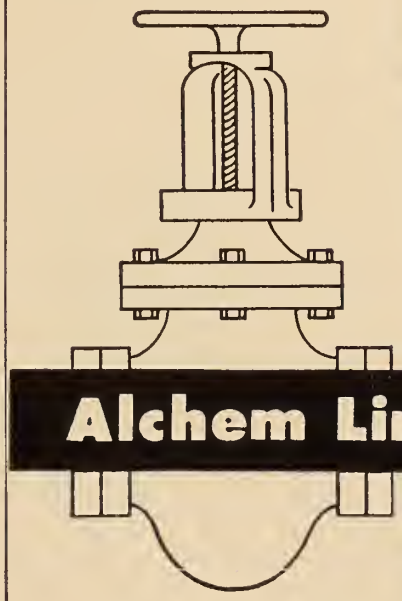

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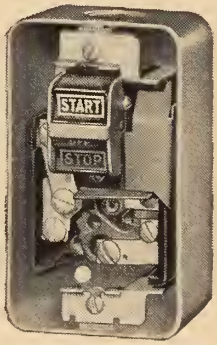

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C. E. Scott, JR.E.I.C., is with the Nylon Intermediates Project of the Canadian Industries Limited at Montreal, Que.

Previously he was working in the Development Section of the Technical Department at the Consolidated Works, Shawinigan Falls, Que.

Mr. Scott graduated from the University of Toronto in 1947.

E. J. Lee, JR.E.I.C., is with the Aluminum Company of Canada at Nechako, B.C.

Mr. Lee graduated with a B.A.Sc. degree in civil engineering from the University of British Columbia in 1950.

P. E. Lafrance, JR.E.I.C., is Acting City Engineer for the City of St. Lambert, P.Q. Previously he worked with the Montreal Engineering Company Limited, at Chicoutimi, Que.

Mr. Lafrance graduated from the Nova Scotia Technical College in civil engineering in 1949.

B. K. Willard, JR.E.I.C., has moved from Montreal to Toronto, Ont. with the Eastern Power Devices Limited.

Mr. Willard graduated in engineering physics with a B.A.Sc. degree from the University of Toronto in 1950.

R. F. Wade, JR.E.I.C., is with the Pentagon Construction Company at Isle Maligne, Que.

He has been with this company at Montreal since 1950.

Mr. Wade graduated in civil engineering from the Nova Scotia Technical College in 1949.

C. J. Langston, JR.E.I.C., is employed by the Aluminum Company of Canada at Shipshaw, Que. He graduated in electrical engineering from McGill University in 1950.

Lieutenant L. Gwynn Holtby, JR.E.I.C., is working as an instructor in the H.M.C. Electrical School, in the electrical branch of the Royal Canadian Navy at Halifax.

Lt. Holtby graduated with a B.A.Sc. degree in electrical engineering from the University of British Columbia in 1950.

Jean-Paul Godin, JR.E.I.C., is employed by the Federal Government at the Ministere des Transports, Services Maritimes, at Quebec.

Mr. Godin was previously an assistant resident engineer with the Department of Public Works, Quebec.

He graduated in civil engineering from Ecole Polytechnique in 1949.

S. A. Fougere, JR.E.I.C., is with the R.C.E.M.E. at Kingston, Ontario.

Mr. Fougere graduated in electrical engineering from the Nova Scotia Technical College in 1950.

R. F. V. Reid, JR.E.I.C., has left the "Canadian Builder", Holliday Publications Ltd. and has joined the "Architectural Forum" in New York, U.S.A.

Mr. Reid graduated in mining engineering from the Imperial College of Science and Technology, London, England in 1949.

L. Pease, JR.E.I.C., is assistant research officer with the National Research Council of Canada, on the Atomic Energy Project.

Mr. Pease graduated in engineering physics from the University of Saskatchewan in 1950 and received a bursary to do further work there in physics; he received his M.Sc. last year at the Fall Convocation of the University.

H. G. Rindress, Jr.E.I.C., is with the Public Works Department (Canada) at Halifax, N.S.

Previously he was with the Department of Mines and Resources, Topographical Survey at Ottawa, Ontario.

Mr. Rindress graduated in civil engineering from McGill University in 1948.

D. M. Pattillo, Jr.E.I.C., has left the Copper Refining Division of the International Nickel Company of Canada Limited and is working with T. S. Patillo and Company Limited at Truro, Nova Scotia.

Mr. Pattillo had been working with the International Nickel Company Limited as a junior chemical engineer since graduating with a B.A.Sc. degree in chemical engineering from the University of Toronto in 1950.

J. N. Keen, Jr.E.I.C., is with Carrier Engineering Limited of Toronto, Ontario.

Previously he was a research engineer with the American Locomotive Company at Dunkirk, New York, U.S.A.

Captain J. A. A. Morrison, Jr.E.I.C., has been serving for the past year in Korea in the 57 Canadian Field Squadron, R.C.E., Permanent Force.

For the past few months he has been on loan, acting as second in command of No. 64 Field Park Squadron, R.E., a British Unit.

He graduated from the University of Toronto in civil engineering in 1950. He earlier completed five years in the R.C.A.F. as a navigator, with the rank of flight lieutenant.

S. Godbout, Jr.E.I.C., is working with the Quebec Hydro Commission at Montreal.

Previously, he was resident engineer on road construction for the Department of Mines at Quebec.

Mr. Godbout graduated with a B.A.Sc. in civil engineering from Ecole Polytechnique in 1946.

C. S. White, Jr.E.I.C., has been transferred to Ottawa to work at the district office of the Canadian General Electric Company as aircraft equipment specialist, sales engineer. He was previously on an engineering test course with C.G.E. at Toronto, Ontario.

Mr. White graduated in mechanical engineering with a B.A.Sc. degree from the University of British Columbia in 1950.

R. H. Forsberg, S.E.I.C., is working with Western Forest Industries Limited at Gordon River, British Columbia.

Mr. Forsberg graduated in forestry engineering from the University of British Columbia in 1951.

James A. Chant, S.E.I.C., is with Canadian Industries Limited at Montreal, Que.

Mr. Chant graduated in mechanical engineering with a B.Sc. degree from the University of Toronto in 1951.

J. R. Boisvert, S.E.I.C., is with Canadian Industries Limited at Montreal, working in the engineering department.

Mr. Boisvert graduated in civil engineering from McGill University in 1951.

W. Shakotko, S.E.I.C., is with Canadian Westinghouse Company at Hamilton on their graduate training program.

Mr. Shakotko graduated in electrical engineering from the University of Saskatchewan in 1951.

Jean Rousseau, S.E.I.C., has recently received a $200 bursary donated by Quebec Professional Engineers Corporation.

Mr. Rousseau received the Maheu and A.F.C.S. prizes while attending St. Mary's College and recently won an Athlone fellowship for two years studies with British Industries in the United Kingdom, after completing his course at the Polytechnical School.

Colin D. di Cenzo, S.E.I.C., has been awarded an Athlone Fellowship for two years post-graduate studies in the United Kingdom. Mr. di Cenzo is a member of the graduating class for this year in electrical engineering at the University of New Brunswick; he is also an electrical officer in the Royal Canadian Navy in which he enlisted in 1941.

H. F. Lawson, S.E.I.C., (University of Toronto, civil engineering, 1952) is employed with the Department of Transport.

J. P. Osler, S.E.I.C., has been awarded a $200 bursary by the Corporation of Professional Engineers of Quebec.

Mr. Osler is a fifth year engineering student at McGill University.

J. M. Squire, S.E.I.C., is with the Metropolitan Vickers Electrical Limited in Manchester, England.

Mr. Squire graduated in mechanical engineering from the University in 1951.

Andrew Frame, S.E.I.C., is employed by the Canadian Westinghouse Company at Hamilton, Ontario, on their graduate student training course for engineers.

Mr. Frame graduated from the University of Toronto in electrical engineering in 1951.

W. Odinotski, S.E.I.C., is with Shawinigan Chemicals Limited at Shawinigan Falls, Que.

Mr. Odinotski graduated in chemical engineering from McGill University in 1951.

Jean-Roch Brisson, S.E.I.C., is taking additional studies as an Athlone scholar at Middlesbrough in Yorkshire, England.

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

Visitors to Headquarters

W. L. Foss, M.E.I.C., Lethbridge, Alberta, February 29, 1952.

A. C. Northover, M.E.I.C., Leamington, Ontario, March 12, 1952.

D. Beatte, Jr.E.I.C., Georgetown, Ontario, March 13, 1952.

F. D. Stanley, Calgary, Alberta, March 17, 1952.

James Pollock, Montreal, Que., March 20, 1952.

K. D. Hutchinson, Montreal, Que., March 20, 1952.

J. Zalite, M.E.I.C., Montreal, Que., March 20, 1952.

G. T. L. Andrews, M.E.I.C., Kingston, Ontario, March 22, 1952.

T. H. Shillingford, Jr.E.I.C., Halifax, Nova Scotia, March 22, 1952.

Aerial Survey

A LOGICAL DIAGRAM

"I 'spect I growed," said Topsy in Uncle Tom's Cabin. "Don't think nobody never made me".

This famous remark deserves contemplation by municipal authorities faced—sooner or later—with traffic congestion, inadequate public services, "black" areas, and strangulation of the metropolitan core by mushrooming suburbs. These common municipal ailments are more than partly due to the fact that most towns, like Topsy, just "growed".

Freely moving traffic, good municipal services and firm property values do not just happen—they are planned. And, because plans are only sound if based on adequate knowledge, surveys of nature's limitations imposed by land-form on haphazard civic growth are prerequisite to workable municipal plans.

Knowledge of topography is expressed on maps. And the most economical and accurate means of compiling good maps quickly is by carefully blending air and ground survey techniques.

Traffic congestion: result of haphazard growth.

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To Daniel Burnham, famed last-century American planner (Beautification Plan for Washington, D.C. etc.), is attributed this quotation: "Make no little plans; they have no magic to stir men's blood . . . make big plans. Aim high in hope and work, remembering that a noble logical diagram once recorded will be a living thing asserting itself with ever growing insistency."

Canada's growth to-day imposes on her municipal authorities a great responsibility. On their foresight depends our future welfare. Canadians must *plan big*, basing their "logical diagram" on knowledge—knowledge of the ground.

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6-52

Obituaries

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

Gordon Macdonald Gilbert, M.E.I.C., who just recently had been chief commissioner of the Greater Vancouver Water Board, died in St. Paul's Hospital in February, 1952.

Mr. Gilbert was born in Ottawa, Ont., on June 2, 1899. He attended Ottawa public schools and the Kelvin Technical High School in Winnipeg. He received his B.A.Sc. degree in civil engineering from the University of Manitoba in 1926. He joined the Vancouver and district Joint Sewerage and Drainage Board as assistant to the chief engineer and was engaged in general design survey and construction work for the Board on various jobs until 1929, at which time he became resident engineer. Later he worked as superintendent of the Board as well as assistant engineer. In 1933 he was appointed superintendent and acting engineer to the Board. He was appointed also to the Greater Vancouver Water District in 1944, and later received the title of superintendent and senior assistant engineer. Earlier this year he was appointed chief commissioner of the Greater Vancouver Water Board and Chairman of the Joint Sewerage Board, to carry out the administration of the Greater Vancouver Water District, after the death of Dr. E. A. Cleveland, M.E.I.C.

Mr. Gilbert was responsible for many large construction projects including the English Bay Interceptor Sewer, and submarine line across the Second Narrows at Vancouver; he was very well known as a water engineer on the continent, and supervised a large part of the engineering for the Cleveland dam now under construction on the Capilano. He was a keen sportsman, active in flying and held a private pilot's licence.

Mr. Gilbert joined the Institute as an Associate Member in 1934 becoming a Member in 1935. He was also a member of the Professional Engineers of British Columbia and the American Water Works Association.

William Harrison, M.E.I.C., who was maritime district manager of the Canadian Westinghouse Co. Ltd., in Halifax, N.S., died suddenly on February 13, 1952.

Born at Dorchester, N.B., in 1884, Mr. Harrison studied at Mount Allison University and at the University of New Brunswick, graduating in 1906 with a degree of B.Sc. in electrical engineering.

He followed the graduate apprenticeship course of the Westinghouse Electric and Manufacturing Company in Pittsburgh, and he worked in the engineering sales department there, going to the sales staff of Canadian Westinghouse Co. Ltd., in Vancouver, B.C., in 1911. He went to Halifax as a sales engineer in 1914, and was appointed district manager in 1938.

He was an associate member of the American Institute of Electrical Engineers and held membership also in the Association of Professional Engineers of Nova Scotia. Mr. Harrison became a Member of the Institute in 1943.

Commander Thomas Fife, M.E.I.C., chief inspector of ships, Inspection Services, Department of National Defence, Ottawa, died suddenly on February 23, 1952.

A naval engineer who served with distinction in the Royal Canadian Navy during the Second World War and since, Commander Fife was born at Durham, England, on January 21, 1901. He studied at the South Shields Marine School. He served his apprenticeship in marine engineering with the famous builders of destroyers, Messrs. R. and W. Hawthorn Leslie and Company at Newcastle-on-Tyne. Later he went to sea with Furness Withy and Co., serving in a number of the firm's ships, among them the liner *Monarch of Bermuda*.

Before the war, Commander Fife lived in Bermuda where he held an engineering post with the Bermuda Electric Light, Power and Traction Co. He entered the Royal Canadian Naval Reserve at Halifax in 1940 as a lieutenant (engineer) and was appointed to the destroyer *Restigouche*. He served overseas in this ship until May of the following year and was posted back to Canada.

Commander Fife's next appointment took him to Naval Headquarters in Ottawa where he served on the staff of the chief of naval engineering and construction. In November 1943, he was promoted to the rank of lieutenant commander(E) and went to Esquimalt, B.C., as engineer officer in charge of the mechanical training establishment.

Early in 1945 he went to the United Kingdom for training in light fleet carriers and when Canada's first aircraft carrier, HMCS *Warrior* was commissioned in June, 1945, Commander Fife was appointed to the ship in charge of machinery.

Commander Fife transferred to the Royal Canadian Navy in September, 1945, and in January 1946, was promoted to Commander. In February, 1947, he became manager of the engineering department in the dockyard at Halifax. Two years later he came to Ottawa for duty with the assistant chief of naval technical services(ships).

In 1949 Commander Fife was seconded to Inspection Services of D.N.D., and was detailed to organize the Ships and General Engineering Branch of that Service. His responsibilities covered the inspection of all components used in the naval ship-building program.

Commander Fife joined the Institute as a Member in 1944.

Col. John Angus Macdonald, M.E.I.C., who was chief electrical engineer for the Dominion Iron and Steel Corporation, at Sydney, N.S., died at his residence on February 13, 1952.

Col. Macdonald was born at Sydney Forks, N.S., on December 11, 1880. He began his career of distinguished engineering service with the Nova Scotia Steel and Coal Company Limited in 1904. He worked in the electrical department on electrical construction, transmission and maintenance and was appointed general foreman for construction.

He enlisted for overseas service in the First World War in August of 1914. While overseas, with the successive ranks of captain, major, lieutenant-colonel, he distinguished himself in the 3rd Brigade, C.F.A., receiving the D.S.O. and bar, and being five times mentioned in dispatches. He returned to Canada in 1919. During the latter months of the war he had been acting C.R.A. for the First Canadian Division.

On his return to Canada, Col. Macdonald joined the Dominion and Steel Company Limited, as engineer in charge of construction, at No. 3 Power Plant. He was made electrical superintendent in 1922, in charge of all electrical construction and maintenance at the Sydney plant. He held this position until the time of his death, having supervision of all electrical installations in Company power houses, transmission lines and substations. During this time extensive modernization was undertaken under his guidance. In 1941 the plate mill was improved for special production of ships plate for the government. Col. Macdonald was just recently engaged in plans for the electrification of the blooming mill.

Col. Macdonald joined the Institute as a Member in 1944 and served as chairman of the Cape Breton Branch in 1946. He was a member of the Nova Scotia Association of Professional Engineers, a past-president of the Maritime Board of Trade, and a past-president of the Sydney Board of Trade and the Associated Boards of Trade. He led the Boy Scout movement in Cape Breton for some 18 years and the Air Cadet movement since its formation. He was also active in Sydney Sea Cadets and army cadets. During the recent war he made a meritorious contribution as civilian adviser for Army Recruitment in Military District No. 6.

A. Ramsay Moon, M.E.I.C., of Toronto, Ont., who had been in Australia for the past year, passed away while on his way back to England last December. Mr. Moon had been, for the past five years, a consulting civil engineer specializing in welding.

Mr. Moon was born in 1898 in Melbourne, Australia. He graduated from Melbourne University in 1922, where he received a B.A. in civil engineering. After graduation he worked as design checker in a building surveyor's office at Melbourne and, soon after, was made chief steelwork designer for Johns & Waygood Ltd. From 1926 to 1928 he was manager of the engineering department for Robert Bryce & Co. Then he was made technical director E.M.F. Electric

Co. Pty. Ltd. of Australia, manufacturers of welding equipment. In 1931 he went to England and worked for four years as construction engineer for Murex Welding Processes, at Waltham Cross. There followed nine years of service with the Institute of Welding in England, as secretary of the Institute; and as director of research for the Welding Research Council. He served in 1939-1944 as director of the Advisory Service on Welding of the Ministry of Supply in London, returning to the Welding Research Council as director of research. He served from 1945 to 1947 as director of research of the British Welding Research Association. He came to Canada in 1947.

Mr. Moon joined the Institute in 1949 as a Member. He was a Member also of the Institution of Structural Engineers, London; the Institute of Welding, London; and the Association of Professional Engineers of Ontario.

Mr. Moon contributed to the science of the use of welding in structural and general engineering and in the earlier years of his career lectured widely and collaborated in the preparation of British Standards for Welding. For the Ministry of Supply during the last war, he founded and organized the Welding Training Centre at Portobello, Edinburgh. His textbook "The Design of Welded Steel Structures" was published by Pitman. He contributed papers to the Institution of Civil Engineers, the Institution of Structural Engineers, and the Royal Institute of British Architects, and lectured to Universities and technical bodies.

Maurice Takeshige, JR.E.I.C., lecturer with the Department of Civil Engineering at McGill University, died on February 4th.

Mr. Takeshige was born in Paris, France, in 1924 and was educated at the High School of Montreal and graduated in civil engineering from McGill University in 1942. During the summer of 1943, he worked in the engineering department of Noorduyn Aviation Ltd., and in 1943 with the topographic survey party in the Department of Mines and Resources, at Ottawa. Later he was with the Champlain Construction Company Limited at Chicoutimi, Que. He had been a lecturer at McGill since 1949.

Mr. Takeshige joined the Institute as a Student Member in 1944 and became a Junior in 1949.

Harold Goldstein, S.E.I.C., of Winnipeg, Man., died last August 18, 1951.

Mr. Goldstein graduated in mechanical engineering from the University of Manitoba in 1951.

Gaetan Belanger, S.E.I.C., of Montreal, was killed in an automobile accident early this year.

Mr. Belanger was born in Montreal in 1925 and graduated from Ecole Polytechnique in 1951, where he received a B.A.Sc. degree in civil engineering. During the summers 1946-1951, Mr. Belanger worked as a surveyor for the Commission des Eaux Courantes and for the Department of Roads at Quebec. On completion of his studies he worked for the Bell Telephone Company for a time before joining the construction firm, H. J. O'Connell Ltd. Mr. Belanger joined the Institute in 1950 as a Student.

Elections and Transfers

At the meeting of Council held at Headquarters on Saturday, March 22nd, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

B. C. Affleck, *Nelson.*
E. B. Allsopp, *Edmonton.*
D. L. Angus, *Toronto.*
A. G. Bamford, *Kitchener.*
W. Bisset, *Port Hope.*
V. S. Bright, *Port Alice.*
W. F. Bucherer, *Montreal.*
R. K. Buhr, *Cobourg.*
F. Z. Bumbulis, *St. John's.*
H. V. Denyer, *Fredericton.*
B. A. Ellis, *Edmonton.*
S. L. Fear, *Toronto.*
J. F. Flett, *Sarnia.*
A. M. Gilday, *Montreal.*
J. S. Horam, *Halifax.*
A. G. W. Lamont, *Port Hope.*
J. F. McDiarmid, *Hamilton.*
N. W. McLeod, *Toronto.*
E. F. Marston, *Port Hope.*
R. F. Martin, *St. John's.*
M. Moorhouse, *Winnipeg.*
K. M. Mote, *Cornwall.*
J. W. Newby, *Calgary.*
H. E. Ney, *Asbestos.*
J. S. Olesinski, *Sherbrooke.*
M. Puziak, *Sarnia.*
R. Radovich, *Toronto.*
J. L. Richards, *Ottawa.*
R. E. Richardson, *Port Hope.*
J. D. Rogers, *Fredericton.*
J. K. Ross, *Arvida.*
O. Schulze-Schwanebrugge, *Montreal.*
J. F. Semple, *Aberdeen, Scot.*
L. E. Slaght, *Charlottetown.*
S. W. Sobrorowski, *Montreal.*
V. Soomet, *Montreal.*
C. M. Stanbury, *Crystal Beach.*
H. Todd, *Niagara Falls.*
G. G. Vallee, *Sherbrooke.*
O. V. Vrany, *Montreal.*
R. T. Waddington, *Walkerville.*
N. J. Weedmark, *Copper Cliff.*
R. C. Wilson, *Port Hope.*
H. S. Winfield, *Port Hope.*

Juniors:

A. G. Ackerman, *Windsor.*
R. E. Alexander, *Arvida.*
G. J. Blanc, *Montreal.*
D. W. Briden, *Shawinigan Falls.*
G. D. Burwash, *Kingston.*
R. M. Cooper, *Montreal.*
C. V. Davies, *Windsor.*
G. Gagnon, *Montreal.*
D. M. Gibson, *Toronto.*
R. Haliburton, *Cornwall.*
D. E. Helleur, *Kenogami.*
T. J. Hobson, *Niagara Falls.*
A. Kielland, *Arvida.*
W. Kralka, *Winnipeg.*
J. M. Lawrence, *Calgary.*
Y. O. Lee, *Niagara Falls.*
T. R. Leslie, *Sydney.*
S. F. Ma, *Hamilton.*
B. S. Madsen, *Toronto.*
A. P. Martin, *Brandon.*
W. H. Pent, *Montreal.*
J. G. Rehak, *Montreal.*
R. H. Routliffe, *Sarnia.*
G. R. O. Thim, *Montreal.*
A. M. A. J. Tielens, *Shawinigan Falls.*

Transferred from the class of Junior to that of Member:

W. E. Boyle, *Edmonton.*
G. T. Davis, *Peterboro.*
F. E. Dembiske, *Kamloops.*
J. S. Foster, *Montreal.*
J. M. Gandy, *Montreal.*
G. H. Green, *San Luis, Cal.*
A. R. C. Hargrave, *Montreal.*
D. G. Heal, *Vancouver.*
R. H. Light, *Port Hope.*
J. O. McCutcheon, *Port Alberni.*
H. J. Moore, *Valleyfield.*
W. M. Newby, *Niagara Falls.*
G. E. Poole, *Edmonton.*
J. L. Sylvester, *Port Hope.*
G. M. Wright, *Hull.*

Transferred from the class of Student to that of Member:

J. M. Fletcher, *Danville.*

Transferred from the class of Student to that of Junior:

J. H. Murchison, *Coxheath, N.S.*
R. Pinsent, *Toronto.*

The following Students were admitted:

University of Toronto

W. L. Angus
R. H. Anson-Cartwright
C. T. C. Armstrong
G. R. Burns
I. D. Campbell
W. M. Carr
W. P. Clement
D. L. Crann
E. Cuplinskas
R. E. Curtis
A. L. Dantzer
J. Drummond
A. M. E. Durnford
V. T. Earl
D. L. Eperjesy
D. J. Fredenburg
L. Gasner
I. A. Gibbons
A. R. S. Gordon
E. A. Guppy
V. A. Harvey
R. W. Hitchen
R. S. Hookings
C. C. Husband
P. J. Hutchison
J. Jacobs
W. O. Johnson
J. Kit
R. C. Klingender
W. A. Kreitner
N. Kunashko
T. Lako
D. B. Langford
N. T. Lazarou
W. G. Low
T. J. McCann
J. C. MacDonald
J. P. McGoey
F. D. McIntosh
D. W. McQuade
R. A. McRae
J. P. Markham
D. P. Martinello
L. L. May
R. L. Norman
L. J. O'Connor
H. Orlando
G. R. Pangborn
G. E. Partridge
J. C. Platt
L. A. Quinn
D. G. Robinson
J. N. Rossall
O. Schavo
E. H. Scott
M. Simko
C. H. Smith
D. M. N. Smith
M. V. Spence
J. L. Stepan
D. R. Stevenson
R. W. Sullivan
G. F. Tanton
R. G. Taylor
M. L. Tung
R. E. Turner
E. S. Tyityan
R. Voldemars
J. C. Vrana
C. E. Welsh
J. A. West
V. F. Wilcox
V. C. Wright
J. A. Young

Laval University

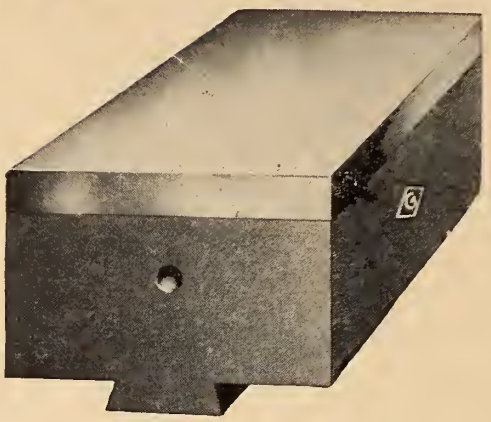
J. C. Baril
R. C. J. Beaulieu
J. A. F. Belanger
P. E. Bergeron
G. Blouin
P. Bois
E. Boivin
J. Bouliane
J. Boutet
R. J. G. J. Cantin
G. Chabot
A. Charbonneau
M. L. O. J. Charest
P. DeMontigny
B. Desjardins
R. Ducharme
G. Duchesne
C. E. Duquet
J. J. Filteau
G. Hinse
J. B. Kaczkowski
B. Karpoff
P. P. Labrie
G. H. Lachance
A. Laflamme
M. Larochelle
J. L. L. Marchand
J. R. M. Marmen
J. D. V. Matte
J. F. McGowan
J. P. O'Gallagher
J. L. G. Ouellet
J. Page
B. Panneton
J. C. B. Paquin
J. L. G. Pedneault
A. Pinault
J. J. Plante
J. G. A. C. Pouliot
J. Pouliot
L. Samson
R. E. Seguin
A. Sirois
L. Tellier
G. Tremblay
G. Tremblay
Y. Trudel

University of Alberta

W. A. Dowling
R. B. Erb
P. Fetsko
H. Gray
C. E. Laverty
M. S. Magas
L. A. O'Morrow
W. G. Sterling

Canforge

DYSON DIE BLOCKS for Dependable Long-Life Performance



The name DYSON represents more than 35 years experience in forging and heat treating Die Blocks and special steels. Dyson Die Blocks have been quality proved in service, and by comparison in our own large drop forging plants. They mean longer life and lower operating costs.

This illustration shows larger size Die Blocks made for the forging of aircraft parts.

Dyson Die Blocks and Upsetter Die Blocks are made from high quality Alloy Steel, normalized and tempered, top and bottom faces planed, oil hardened and tempered to four standard hardness ranges.

Inserts and Insert Bars are made from high quality Alloy Steel, normalized, oil hardened and tempered to four standard hardness ranges.

Dyson Die Blocks can also be supplied in the annealed condition when sinking prior to hardening is desired. Heat treating data furnished on request.

Dyson Die Blocks are supplied faced top and bottom only. Supplied shanked on request.

Catalogue giving complete data on Dyson Die Blocks supplied promptly on request

CANADA FOUNDRIES & FORGINGS
LIMITED · WELLAND, ONT.
MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

Queen's University

J. G. Anderson
D. C. Cryderman
G. E. Elliott
R. T. Haine
H. K. Menna
A. Parnamagi

Nova Scotia Technical College

E. F. Cook
R. S. Jermyn
W. G. L. McAllister
G. C. McCausland
W. E. Robinson
E. R. Skanes

Royal Military College

A. J. Beemer
J. R. Cote
N. E. Cressey
B. P. Dowsley
C. A. Lowry
J. W. Morewood

McGill University

P. C. Bhasin
J. A. Kane
W. S. Kennedy

University of New Brunswick

C. C. Atkinson
I. C. Colquhoun
G. R. Wetmore

University of British Columbia

H. I. Thomas — Hamilton, Ont.
W. L. Phillips — Montreal, Que.
J. E. G. Spencer

Applications Through Associations

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

ALBERTA

Members:

J. A. Beveridge.
P. H. Buckland.
J. H. Donovan.

Junior:

I. J. Krpan.

Junior to Member:

W. E. Hawkins.
A. Shapiro.
A. G. Underhill.
R. T. White.

SASKATCHEWAN

Member:

J. W. Spyker.

Juniors:

J. E. Whenham.
A. Winer.

Students:

R. H. Banks.
M. J. Gavel.
J. F. King.
O. K. C. Mang.
J. R. Wright.

Junior to Member:

E. B. Campbell.
A. T. Given.
M. F. Pardoe.
H. R. Skinner.

Student to Junior:

J. A. Bryan.
E. Davis.
R. J. Genereux.

NOVA SCOTIA

Members:

D. F. Dunham.
F. J. MacDonald.
H. D. Smith.
R. B. Webber.
C. Wachmann.

Junior to Member:

G. Biard.
G. R. Maitland.
J. F. More.
K. W. McGrail.

QUEBEC

Juniors:

J. P. R. Cristel.
P. E. Larose.
S. Meland.

Employment Service

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

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

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

Situations Vacant

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to file number 4208-V.

CHEMICAL ENGINEER for development and control work in a pulp and paper mill located in Province of Quebec. Good starting salary, excellent opportunities. Apply in detail. Apply to File No. 4222-V.

CHEMICAL ENGINEER, recent graduate required for technical work in sales department of well established Toronto manufacturer. Apply to File No. 4223-V.

CHEMICAL ENGINEER required with intimate experience in the field of biochemistry and allied processes. Man needed for this position must be capable of giving independent direction on various projects under way. Should have no objection for overseas duties. Present staff have been informed. Apply to File No. 4230-V.

CIVIL

CIVIL ENGINEER required by construction company in Montreal. Applicant should be graduate engineer with at least 5 years experience in airport and road construction and familiar with asphalt operations. Duties include estimating, job planning and supervision. Apply to File No. 4207-V.

CIVIL ENGINEER, recent graduate, preferably with some experience on reinforced concrete design of hydro-electric structures such as dams, powerhouses, and pumping stations is required by a large Canadian company with operations in Brazil. Location Toronto. Pension plan and other benefits. Apply to File No. 4225-V.

CITY ENGINEER required by large city in Western Canada to act as administrative head of the City Engineering Department to promote, plan, coordinate and direct the executive of all municipal engineering projects. University graduate in civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or an equivalent combination of training and experience. Apply to File No. 4227-V.

ASSISTANT HYDRAULIC ENGINEERS for water rights branch, Department of Lands, Victoria, B.C. Salary $288.00 to $338.00. Graduates in engineering, preferably civil; eligible for registration as engineer-in-training in B.C., Professional Engineers' Association. Photogrammetry, hydraulics and hydrology of river discharge, some knowledge of dam design, soil mechanics and soil sampling, preferably some experience on engineering work in hydro-electric, irrigation or hydrology fields. Positions permanent. Superannuation plan. Promotion to hydraulic engineer, maximum salary $413.00 on completion of full professional registration. British subjects, under 45 years, unless ex-servicemen. Apply to File No. 4228-V.

BRITISH FIRM specializing in reinforced concrete and structural steel design requires Canadian born Civil Engineer representative in Canada. Age 26 to 45, salary $8,000 to $12,000, according to age, and experience. Select applicants will be interviewed in Toronto, 1st to 10th May; Montreal, 12th to 20th May; and Ottawa, 21st to 25th May, 1952. Apply to File No. 4233-V.

SEVERAL ENGINEERS with ability and initiative wanted as soon as possible, for young company; will eventually become a partner if satisfactory. Specializing in sewers, waterworks, and roadwork. When applying, please state age, graduation, references, salary expected, and full particulars, to File No. 4232-V.

ELECTRICAL

ELECTRICAL ENGINEER required by manufacturer in Ottawa, Ontario. Applicant should be capable of both sales and development work, the development work would involve the preparation of schematic and actual wiring diagrams and field service work. Apply to File No. 4204-V.

ELECTRICAL ENGINEER with communications option or graduation in physics required in Montreal. Previous experience with air force electronics work desirable but not essential. Should be able to write and interpret specifications and be office type as this is altogether desk work. Salary open. Apply to File No. 4210-V.

ENGINEER REQUIRED by electrical manufacturer in Toronto to engineer, produce and sell electrical connectors. Apply to File No. 4229-V.

ELECTRICAL ENGINEER to act as sales engineer for manufacturer located in Toronto of electrical and power house equipment. Some experience desirable and free to travel. Company car supplied. Apply to File No. 4229-V.

MECHANICAL

MECHANICAL ENGINEER required by manufacturer in Ontario. Applicant should be about 35 years and have 5 to 8 years practical experience, preferably in automotive, structural sheet and plate products. Applicant should supply good references and state salary expected. Apply to File No. 4213-V.

MECHANICAL ENGINEER, age 25 to 35, with experience or aptitude for sales, preferable with knowledge of paper mill industry. Should be graduate engineer who can represent nationally known industrial concern in Quebec and Eastern Ontario dealing with management and technical personnel on sales problems related to paper industry. Sound technical background, initiative and ability to handle problems are prime requirements. An excellent future and attractive remuneration for the right man. Give details of background and approximate salary level required. Enclose photo if possible Apply to File No. 4214-V.

MECHANICAL ENGINEERS for process and/or mechanical engineering work required by large pulp and paper mill. Single men preferred who have experience in the paper industry although experience is not absolutely necessary. Apply to File No. 4218-V.

ASSISTANT PROFESSOR for vacancy on the mechanical engineering staff of a University located in the Maritimes, to teach various subjects to third and fourth year students. Applicant should have preferably some teaching experience. Would consider application from anyone interested in university work who has had a few years of industrial experience. Apply to File No. 4221-V.

MECHANICAL ENGINEER PREFERABLY a recent graduate, required by well established Toronto manufacturer for factory engineering department. Apply to File No. 4223-V.

MECHANICAL ENGINEER required to act as assistant plant engineer. Applicant must have previous maintenance experience, preferably in Chemical industry. Apply to File No. 4226-V.

MISCELLANEOUS

SALES ENGINEER for Toronto office of large railway supply organization. Practical mechanical ability an asset. Railway experience preferred but not absolutely necessary. Excellent opportunity for young aggressive man. Pension plan, automobile, etc. Write giving details and including photograph to File No. 4202-V.

TECHNICAL EDITOR required by rapidly growing research organization (both fundamental and applied). First class man to advise in the initial draughting, and carry out final processing, of scientific and technical communications. This man must be capable of working with project supervisors toward the clear and accurate expression of research concepts and results. A science degree and published research, plus some writ-

City Engineer Required by City of Calgary

DUTIES

As administrative head of the city Engineering Department to promote, plan, co-ordinate and direct the execution of all municipal engineering projects including the construction and maintenance of bridges, underpasses, streets, roads and sidewalks; the development, maintenance and operation of sewers, sewage disposal plants, garbage collection and disposal system; traffic control; and the building inspection program. To prepare estimates and budgets and report on departmental activities. Applicants should advise concerning experience in supervision of water works treatment and distribution system.

QUALIFICATIONS

University graduation in civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or and equivalent combination of training and experience.

APPLICATIONS

To be made in writing to Personnel Director, City Hall, Calgary, Alberta, stating salary required.

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ing experience are therefore essential, academic and industrial experience are both desirable. Salary commensurate with qualifications, permanent position, central location in Montreal. Reply giving full resume of career to File No. 4203-V.

CHEMICAL ENGINEER or practical chemist required by American organization to establish headquarters in Windsor, Ontario, and travel in Canada. Initial assignment would be plan and help implement a sales programme in the metal treating chemicals field. Applicant must be sales minded and preferably with experience in chemical sales. He should be between 30 to 40 years of age and be a Canadian citizen. Of prime importance he must be able to work with present personnel gracefully and gradually assume a position of leadership. He must be of executive calibre and proven ability. Apply to File No. 4205-V.

ASSISTANT AGRICULTURAL engineer for research and teaching of rural electrification in the agricultural engineering department of an eastern Canadian agricultural college. Bachelor of Science in agricultural engineering or electrical engineering with master's degree relative to subject of rural electrification. Good opportunities for development work and promotion. Salary based on training and experience. Apply to File No. 4206-V.

ASSISTANT ENGINEER for research and teaching of farm machinery in the agricultural engineering department of an Eastern Canadian college. Research will include field experimental work on tillage and harvesting machinery primarily. B.S. degree in agricultural engineering or equivalent with M.S. degree with major emphasis on farm machinery. Farm background and good co-operation with initiative and willingness to work essential. Good opportunity for growth and promotion. Salary open depending on training and experience. Apply to File No. 4206-V.

SALES ENGINEER required by manufacturer in Montreal. Applicant should be graduate in electrical engineering or electronics and have about 3 or 4 years experience in sales work. Apply to File No. 4209-V.

GAS DISTRIBUTION engineer, required for a Canadian company operating in Rio de Janeiro, Brazil. Duties will include supervision of distribution mains, regulators, meters, compressors, balancing gas pressures and preparing surveys of expected demand. Prefer applicants with higher certificate in gas engineering supply of the Institute of G.E. Apply to File No. 4211-V.

ENGINEERS REQUIRED by large industry in Ontario in aircraft wing plant; process engineers, training supervisor. Maintenance department; mechanical engineers and construction design engineers. Industrial engineering; materials handling engineers and tool and die designers. Apply to File No. 4212-V.

ENGINEER REQUIRED in Western Canada to take charge of water metering system and allied duties. Apply in writing only. Give full details of education, experience and other experience references, salary expected and such personal facts as age, marital status, physical disabilities if any, etc., and state when available. Apply to File No. 4215-V.

JUNIOR PLANNER for metropolitan planning commission of Greater Winnipeg. Qualifications: graduate in architecture or engineering, preferably with specialization in planning or graduate in other related fields with some planning experience. Duties: zoning, subdivision problems, and draughting related thereto. Salary $3,000 to $3,600 per annum. Apply to File No. 4216-V.

LUBRICATION ENGINEER required in a large Eastern Canadian paper mill. Applicants should state age, experience, marital status, as well as other relative information. Apply to File No. 4217-V.

ENGINEER to take charge of lecture and laboratory work in industrial electronics and servo mechanisms at a university in Eastern Canada, commencing September, 1952. Rank and salary dependent on qualifications. Apply to File No. 4219-V.

TRANSFORMER DESIGN ENGINEER required by well established organization in Ontario. Real opportunity offered in an expanding organization for a progressive engineer. Five years distribution transformer experience desirable, but not essential, for the man possessing other suitable qualifications. Reply should include general personal data, detailed experience record, with specific regard to types of transformers designed and recent photo. Apply to File No. 4220-V.

SALES ENGINEER required by well known manufacturer of product used in Canadian Pulp and Paper industry has opening for salesman in the thirties, preferably with background in paper manufacturing or sales and with technical education. Unusual opportunity for right man. Would have several months training in our own plant and in the field. Apply to File No. 4224-V.

ENGINEERS in training B.C. Forest Service. Salary $258-$308 per month. Graduate in civil or forest engineering, registered as engineer in training with Association of Professional Engineers of B.C. Promotional opportunities, positions permanent, superannuation plan. British subjects, not over 45, except ex-servicemen given preference. Apply to File No. 4228-V.

CITY IN ONTARIO is organizing a planning department and asks for applications for the position of Planner. Work includes revision and consolidation of the zoning by-laws, screening subdivisions, major street system, and school building programme. Experience in planning is desirable but not necessary. Applicants must be university graduates with a definite interest in planning, and preference will be given to training in engineering. Please state salary. Apply to File No. 4231-V.

MECHANICAL OR CHEMICAL ENGINEER with a minimum of one year's experience in the mechanical or chemical engineering branches. The position to fill is that of sales engineer and field representative. Considerable travelling will be involved in all parts of Ontario and Quebec, and occasionally in other provinces and the U.S. The work will involve following up inquiries, preparing and submitting quotations, assisting customers in engineering design, and negotiating engineering details of orders and contracts. The base of operations will be from Head Office in Ontario. Apply to File No. 4234-V.

JUNIOR ELECTRONICS ENGINEER for work on HF Transmitter. Location Montreal. Apply to File No. 4235-V.

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

CHEMICAL

CHEMICAL ENGINEERS with 2 to 4 years operating experience in the chemical industry. Successful applicants will be given a 6 months special training period in the U.S.A. before being permanently located in central Alberta by major organic chemical industry in the production department. Apply to File No. 4075-V.

TWO 1952 GRADUATES in chemical engineering required pulp and paper manufacturing company in Eastern Townships for investigations, under direction, of specific characteristics of operating processes and equipment, and of the manufactured product. Apply to File No. 4159-V.

CHEMICAL ENGINEER, preferably a recent graduate required by a well established Toronto manufacturer for laboratory work on production problems. Apply to File No. 4179-V.

CHEMICAL ENGINEER, recent graduate preferred, with or without past graduate work. The position is that of chemical process design involving hydrocarbon distillation and heat exchange. This is a good opportunity for a young engineer to develop his theoretical and practical knowledge in one of the most advanced applications of thermodynamics. Salary according to qualifications. Location Montreal. Send complete resume of education, experience if any, and recent photo to File No. 4197-V.

CIVIL

YOUNG CIVIL ENGINEER for large transportation company located in Montreal in track department. Duties include general engineering work including some design. Experience not necessary. Apply to File No. 4041-V.

CIVIL ENGINEER required in design office of medium sized base metal mine, situated in northern Ontario. Experience in structural and plant design necessary. Salary commensurate with qualifications. Apply giving full details of qualifications to File No. 4150-V.

CIVIL ENGINEER, recent graduate required for city engineer's office in Ontario. Work involved is concerned with making surveys, layouts, inspection and control of construction of streets, and sewers, and miscellaneous municipal construction. Apply to File No. 4174-V.

CIVIL ENGINEER with from 2 to 4 years diversified experience (office and field) preferably bilingual and experience in municipal work. Location Montreal and free to travel. Salary open. Apply to File No. 4182-V.

ELECTRICAL

RECENT ELECTRICAL ENGINEER required by manufacturer with sales offices in Montreal for sales and service work on machine tools, precision instruments, etc. Territory Kingston to Halifax. Apply to File No. 4142-V.

ELECTRICAL ENGINEER required by large communication organization in Montreal. Applicant should have 1 to 3 years experience. Apply to File No. 4143-V.

ELECTRICAL ENGINEER who has recently completed the power option course in electrical engineering from a recognized university required by paper mill in Province of Quebec. Duties would range from draughting to supervizing electricians and electrical installations in the mill. Although not necessary a bilingual engineer would be preferred. Apply to File No. 4146-V.

ELECTRICAL ENGINEER required by Montreal firm specializing in manufacture, sale and installation of sound equipment, including public address, intercommunication, telephone and specialized communications apparatus Duties include design and supervision. Salary approximately $3,800.00 Apply to File No. 4191-V.

ELECTRICAL ENGINEER required by manufacturer in Ottawa, Ontario. Applicant should be capable of both sales and development work. The development work would involve the preparation of schematic and actual wiring diagrams and field service work. Apply to File No. 4204-V.

MECHANICAL

SALES ENGINEER preferably mechanical for Toronto office of manufacturer of air handling equipment such as fans, heating coils, air conditioning units, etc., to contact consulting engineers and industry. Apply to File No. 4139-V.

MECHANICAL ENGINEER required in Montreal with experience on small assembly production lines, preferably in the electronic industry. Apply to File No. 4153-V.

TWO MECHANICAL ENGINEERS, recent graduates required for initial training in the valve and fitting department of organization in Montreal to be absorbed eventually in sales or other branches. Apply to File No. 4170-V.

MECHANICAL ENGINEER required by manufacturer in Eastern Townships, Quebec, to work as technical assistant to the shop manager. This position would involve initially plant layout for an expansion programme for some one interested in machine tools and heavy machinery. Apply to File No. 4175-V.

MECHANICAL ENGINEERS to act as project engineers with experience in chemical or allied industry preferred but not essential. Location Ontario. Apply to File No. 4176-V.

MECHANICAL ENGINEER or graduate in engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics required for Montreal office of consulting firm. Apply to File No. 4177-V.

MECHANICAL ENGINEER with about 10 years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc., required by Montreal office of consulting engineer. Apply to File No. 4177-V.

THREE MECHANICAL ENGINEERS, university graduates with one or more years of machine design experience. Location Montreal, office of consulting firm. Apply to File No. 4177-V.

MECHANICAL ENGINEERS required by large automotive industry in Ontario for the time standards and methods department and for production engineering. Apply to File No. 4178-V.

MECHANICAL ENGINEER required in Province of Quebec by pulp and paper industry for design and layout. Apply to File No. 4189-V.

MECHANICAL ENGINEER with pulp and paper experience required for Montreal office of the industry. Applicant should have experience in checking, draughting, recording, etc. Salary open. Apply to File No. 4189-V.

YOUNG GRADUATE mechanical engineers required for Mexico, Colombia and other central and South American locations, for a period of two or more years. This is an unusual opportunity for young engineers to be trained under superintendents in various steam and diesel power stations so that their experience would not be limited to one plant or in relationship to only one plant superintendent. After training these engineers would if they wish, be sent to head office in the U.S.A. to act as liaison officers between field and office and thus assist in the start up of new generating stations. A thorough knowledge of the English language is essential. Apply to File No. 4193-V.

MISCELLANEOUS

TWO JUNIOR RESIDENT ENGINEERS required by public works in Newfoundland, for work on highway and bridge construction. Recent graduates or engineers graduating in 1952. The posts are permanent and pensionable on the salary scale of $2,700 to $3,800 per annum, in addition a cost of living bonus of $570 per annum for salaries below $3,100 and $480 for salaries $3,100 and over is applicable. Apply to File No. 4105-V.

ENGINEER, required by City in Ontario. Applicant must be a fully qualified engineer with experience in and capable of directing the operations of road maintenance and construction of sidewalks, curbs and gutters, street cleaning, snow removal and garbage collection and disposal. Experience in the operation of asphalt plants desirable. The man appointed will have complete charge of these operations together with any other duties relative to streets. Salary range $4,500.00 to $5,000.00. Apply to File No. 4134-V.

UTILIZATION ENGINEER required by a Canadian natural gas company experienced in all phases of service work. The company serves 75,000 meters in a number of municipalities which are grouped in four districts. Applicants must be capable of directing district superintendents in service work, installations, inspections, training programmes, etc., as well as direction of a small appliance testing laboratory and preparing installation codes, etc. Applicants should state age, qualifications, experience, references and salary expected. All applications will be treated as confidential. Apply to File No. 4144-V.

SALES ENGINEER required by manufacturer of metal working compounds, chemicals for drawing, grinding, derusting, rust preventing, metal rolling, cutting and point stripping. Territory Montreal and district. Salary and profit sharing. Experience required. Apply to File No. 4148-V.

THE PUBLIC SERVICE OF CANADA requires, 2 engineers $5,980.00-$6,580.00 and three district inspectors (one bilingual) $4,940.00-$5,580.00 (operating and car equipment). Extensive railway experience is essential for these positions. Apply to File No. 4151-V.

RECENT ENGINEERING graduate for Montreal office. Work consists of design and price estimating on air-conditioning and refrigeration equipment. Apply to File No. 4154-V.

TWO 1952 GRADUATES in industrial or mechanical engineering required by pulp and paper manufacturing company in Eastern Townships with skill in mathematical computation and reasoning, interest in report writing. Studies of production methods, plant lay-out, materials handling, etc., wage incentives, time and motion studies, jobs evaluation, etc. Full time course of 3 months duration provided at the outset. Apply to File 4159-V.

TWO 1952 GRADUATES in mechanical or civil engineering required by pulp and paper manufacturing company located in Eastern Townships, with skill in draughting, interest in engnieering development work, participation in studies of mechanical and structural improvements, lay-out and design through on-the-site observation and through drawing board activities. Apply to File No. 4159-V.

MECHANICAL OR CIVIL ENGINEER recent graduate required by Maritime Branch of large Canadian firm, for inside sales office and contact work. Territory Newfoundland and Maritimes. Apply to File No. 4162-V.

CITY OF CALGARY

Alberta, Canada

REQUIRES

An Assistant City Engineer

DUTIES:

As first assistant of the CITY ENGINEER to perform a variety of administrative and advanced technical duties of a professional civil engineering nature in assisting in the promoting, planning, co-ordinating, and supervising of various municipal engineering projects including sewers and sewage disposal, garbage collection and disposal, traffic control, construction and maintenance of bridges, underpasses, streets, roads, sidewalks and building inspection.

QUALIFICATIONS:

University graduation in Civil Engineering, preferably supplemented by post graduate work in the municipal field. Considerable, varied municipal engineering experience, including supervisory responsibility. Successful public relations and administrative experience in municipal government; or an equivalent combination of training and experience.

Apply in writing, stating salary required, to the Personnel Director, City Hall, Calgary, Alberta, not later than April 30th, 1952.

REQUIRED

FOR WORK AT

Montreal Office

One mechanical engineer with about ten years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc.

Three mechanical engineers, University graduates with one or more years of machine design experience.

One graduate in mechanical engineering or engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics.

One mechanical draughtsman, experienced in checking of shop drawings of machinery.

Two mechanical draughtsmen with at least three years' experience.

Apply in writing or in person to:

Manager,
C. D. Howe Company Limited,
Consulting Engineers,
1421 Atwater Avenue,
Montreal 25, Quebec.

Sales Engineer

Well-known manufacturer of product used in Canadian Pulp and Paper Industry has opening for salesman in the thirties, preferably with background in paper manufacturing or sales, and with technical education. Unusual opportunity for right man. Would have several months training in our own plant and in the field. Apply to File No. 4224-V.

MECHANICAL OR ELECTRICAL ENGINEER (preferably mechanical) required by large manufacturer in Eastern Townships, Quebec. Applicant should be interested in plant safety, training period and excellent opportunities offered. Apply to File No. 4175-V.

SALES ENGINEER required with 3 or 4 years experience in sales and development of materials handling, preferably in mining or pulp and paper industry. Location, working out of Toronto or Montreal. Apply to File No. 4185-V.

FOUR MECHANICAL AND THREE electrical engineers required by manufacturer of quality electrical products. Plant located in Ontario. Apply to File No. 4198-V.

COMBUSTION ENGINEER salesman, preferably young man with knowledge of and experience with coal burning equipment and also flair for product research and development. Must have pleasant attributes of sales personality and willingness to travel contacting coal industrial users and retail dealers particularly in Western Canada. Prospect of advancement to sales manager upon proving suitability. Liberal salary plus bonus arrangement to right man. Travel paid and car furnished if necessary. Apply to File No. 4199-V.

OPPORTUNITY FOR A MAN in Vancouver, B.C., who is a graduate mechanical engineer and has had five to ten years' experience in laying out heating and ventilating for buildings of all types. Must have a full knowledge of hot air, hot water and steam systems and their controls. For the first year he would be on salary plus a share of the heating and ventilating profits, after which he may become a partner. Reply with full details of experience, age, references and marital status. Please enclose a recent snapshot and state salary expected. Apply to File No. 4200-V.

Situations Wanted

CIVIL ENGINEER, M.E.I.C., University graduate, 22 years experience abroad and in British Government service in layout design, field supervision of railways, roads, buildings, water supply, drainage, soil mechanics, erosion control, contour survey, mapping, triangulation. 3 years in Canada as chief of survey-parties, resident engineer on National Defence Work, factory construction, railway, road location survey, lines and grades, estate survey, quantity take-off, re-inforced concrete foundations. Married, bilingual. veteran C.R.E., desires progressive position as chief of survey or assistant to senior executive where experience may be utilized combined with aptitude for organization. Suitable recommendations from employers available. Apply to File No. 489-W.

CHEMICAL ENGINEER, McGill University, 1950. Presently employed in U.S. doing design and production work. Would like to return to Western Canada. Desires position in production and process. Apply to File No. 1467-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., married, desires change to a permanent position leading to increased responsibilities and greater opportunities. 8 years experience in light and power design layouts for industrial plants, job instruction and plant operation. 7 years experience in electric utility power plant and substation design, cost estimating and accounting, equipment specifications and contracts, and business administration. Western Canada or Ontario preferred. Apply to File No. 1632-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec, Technical College Stuttgart, 1924, about 18 years experience in Canada in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area preferred. Apply to File No. 1862-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Ontario, 1945, married, 3 children, desires responsible and supervisory position preferably in the plant engineering field. Has broad experience in construction, machine design and layout, maintenance and supervision. Prefers a location in Southern Ontario. Apply to File No. 1997-W.

HEATING AND VENTILATING ENGINEER. M.E.I.C., P.Eng., member A.S.H. & V.E. Many years experience in design and layout. Ten years as head of department for large industrial firm. Available for position of responsibility or as consultant. Apply to File No. 2091-W

CIVIL ENGINEER, B.Sc., M.E.I.C., age 42, married, with 10 years experience in construction and maintenance, including layout and supervision of water supply, sewage systems, municipal engineering, underground mining and industrial buildings. Presently employed but available on short notice. Apply to File No. 2626-W.

ENGINEER MECHANICAL, interested in position offering opportunity as representative, plant or assistant engineer. Experience includes twelve years design, construction and maintenance with pulp and paper industry. Age 40, married. Apply to File No. 2642W.

MECHANICAL ENGINEER, Canadian, age 37, B.Sc., M.E.I.C., P.Eng. (Ont.), 14 years experience in various phases of mechanical engineering, presently employed in a senior engineering capacity, seeking a position (preferably, if possible, in Canada) in which proven design and administrative abilities, plus hard work, alows scope for further advancement. Please apply to File 2745-W.

PROFESSOR OF CANADIAN UNIVERSITY, M.E.I.C., P.Eng., Ph.D., specializing in Mechanical and Industrial engineering, available for summer assignment between May and September. File No. 2929-W.

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

SALES ENGINEER with 20 yrs. experience sales, management, equipment design, advertising and public relations in public utility, construction and export fields is interested in making new connection. Apply to File No. 3057-W.

THREE ENGINEERS, (Grads. London) with an average of three years experience in aeronautical and mechanical engineering, desire part time work in structural, mechanical or aeronautical detailing, and stress analysis, for evenings and Saturdays, in the Toronto area. Apply to File No. 3337-W.

MECHANICAL ENGINEER McGill 1940, M.E.I.C., P.Eng., Quebec. Presently employed in an executive capacity seeks senior position with progressive firm. Experience includes maintenance, plant layout, machine shop, manufacturing, administration and five years as works manager of large engineering plant. References. Apply to File No. 3355-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., A.M.I. Mech. E., Chartered Mechanical Engineer, 1st Class B.O.T. Certificates (Steam and Motor), 1st Class A.B. Stationary Engineer's Certificate. Management, Administration, Construction, Power Plant Operation. Desires more progressive position at Senior Executive level. Apply to File No. 3420-W.

CIVIL ENGINEER, B.Sc., University of New Brunswick, 1949, Jr.E.I.C., age 24, single. 2 years Canadian Hydrographic Service. 7 months as field engineer on construction work. Desires position on construction work, but will consider others. Available on short notice. Apply to File No. 3429-W.

PART TIME EMPLOYMENT graduate civil engineer, Jr.E.I.C., desires part time employment in Montreal for evenings and weekends. Experience in reinforced concrete design, foundations, laboratory testing of concrete, steel and soils. Apply to File No. 3466-W.

CIVIL ENGINEER, Jr.E.I.C., B.Eng. McGill 1949, age 26, married, presently employed by construction firm in Montreal, would offer services for part-time employment in designing, estimating, etc. related to varied fields of building construction especially reinforced concrete, steel, or timber structures and foundations. Apply to File No. 3480-W.

FULLY QUALIFIED MECHANICAL ENGINEER, M.Sc., Ph.D., P.Eng., M.E.I.C., Metallurgical Statistician fully experienced in steel production and steel products. Held top ranking positions in research and industrial development in Europe. Desires position in a Canadian organization able to offer opportunity to use considerable experience. Suitable recommendations from present employer available. Apply to File No. 3521-W.

CHARTERED STRUCTURAL ENGINEER, M.Sc., M.E.I.C., A.M.I., Struct. E., widely experienced in design and erection of reinforced concrete, steel and timber structures, well experienced in prestressed concrete design and construction, capable of supervising or team work. Would accept a position of senior designer. Apply to File No. 3552-W.

ENGINEER ELECTRICAL AND MECHANICAL, employed in Scotland, wishing to settle in Canada, invites employment offers, where drive will bring advancement. Associate member Institution Electrical Engineers, University London inter B.Sc., Mechanical. 5 years works apprentice, welding, machine and assembly depts. 6 years drawing office, 12 years senior appointments in production control and factory management. Experienced in production planning, factory loading, stock control, job methods, rate fixing, factory pricing, mass/batch production and budgetary control. Excellent health, 40 years of age, married two children. Bilingual. References obtainable from Canadian and U.K. executives. Full career details and photograph on application. Apply to File No. 3610-W.

GRADUATE ELECTRICAL ENGINEER, S.E.I.C., Manitoba 1951, married, one child, R.C.A.F. veteran, presently employed, desires to gain experience in electronic design. Willing to work for moderate salary during training period. Montreal or Toronto area preferred. Available on two weeks notice. Apply to File No. 3651-W.

CIVIL ENGINEER, specializing in steel construction. 15 years experience design and construction of mill buildings, industrial and chemical plants, foundations etc. Some experience of reinforced concrete design also. Past 3½ years senior design engineer with large Hydro-electric utility, designing power plant structures, pipe lines and penstocks, switching stations and foundations. Member E.I.C., A.S.C.E., etc. Apply to File No. 3702-W.

CHEMICAL ENGINEER, JR.E.I.C., 1949 graduate, 31 years old, veteran, 2½ years development and production (supervisory) experience in synthetic resin manufacture. Would like position (preferably in production department) in another chemical industry. Apply to File No. 3809-W.

PART-TIME DESIGN WORK requested. Extensive experience in designs of air cylinders actuated devices for woodworking industries. Drafting help available, mechanical drawings detailed. Apply to File No. 3815-W.

MECHANICAL ENGINEER DESIGNER, M.Sc., M.E.I.C., wide experience in Canada and abroad, sound technical, theoretical and practical background, supervisory level. Energetic and conscientious. Desires responsible permanent position with a progressive company. Availability to be discussed. Apply to File No. 3816-W.

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

MECHANICAL ENGINEER, Jr.E.I.C., age 32, married, 6 years experience in design, construction, maintenance, administration and efficiency work in large steam power plant. Desires position either in paper industry or as a plant engineer. Apply to File No. 3823-W.

ELECTRICAL ENGINEER, 41, British, seeks employment in Canada. Toronto, Ontario, preferred. Honours diploma in electrical engineering and associate member of I.E.E. 5 years as draughtsman, 14 years as electrical and mechanical engineer in the paper and rayon industries and with the British Air Ministry. Available at two months notice. Apply to File No. 3824-W.

GRADUATE ELECTRICAL ENGINEER, Jr.E.I.C., 1950 graduate needs change. Wishes to work where he can progress in engineering. Particularly interested in power, generation or heavy industry. Experience includes mine work, summer employment in generating station, and power board. Have position with considerable administrative and supervisory responsibility, but lacking chance of advancing in chosen profession. More complete detail and references on request. Present salary over $4,000. Family man, age 28, overseas veteran. Available by summer. Apply to File No. 3825-W.

ELECTRICAL ENGINEER, M.E.I.C., graduated 1944, married, two dependents. 8 years industrial and supervisory experience, at present assistant to plant manager. Desires responsible position in production field. Experience includes both heavy electrical machinery (motors, transformers, industrial controls) and light manufacturing on a production line basis. Familiar with all phases of manufacturing particularly with labour cost analysis, modern production methods including materials handling, production control and planning and wage incentives. Apply to File No. 3826-W.

PART TIME WORK graduate electrical engineer Jr.E.I.C. desires part time work in Montreal for evenings and week-ends. Some experience in industrial power distribution and pole line construction. Apply to File No. 3827-W.

MECHANICAL ENGINEER, B.A., B.A.Sc., (British College), Jr.E.I.C., age 26, single. Three years experience in estimating, detailing, design and selling of all classes of mechanical handling plant and centrifugal machinery in Canada and Great Britain. Desires progressive responsible position in British Isles with Canadian firm having British affiliations. Salary commensurate to Canadian scale. Apply to File No. 3828-W.

METALLURGICAL ENGINEER, Jr.E.I.C., 1948 honour graduate, married. Two years experience in technical development work on production problems, 1 year as production supervisor. Desires production or development work of a metallurgical nature. Location immaterial. Apply to File No. 3829-W.

MECHANICAL & ELECTRICAL ENGINEER, P.ENG., JR.ASH & VE, age 31, married. Design and supervision of installation of mechanical and electrical equipment for buildings, 3 years in contracting, ventilation and air conditioning. Last six years and presently employed with consulting engineers office on industrial and hospital design. Willing to take complete charge of project including work of junior draftsmen. Apply to File No. 3830-W.

CIVIL ENGINEER, B.Sc., University of Manitoba 1939, M.E.I.C., P.Eng., age 35, married, two children, veteran R.C.A.F., nine years experience in all phases of construction on job and office administration, plant superintendent, experience also as resident engineer and mechanical superintendent. At present superintendent of construction in complete charge of large project in the West. Desire responsible position with good future preferably with firm in Ontario. Apply to File No. 3831-W.

GRADUATE ENGINEER, London University 1950, mech/elect. (28) recent immigrant, seeks a responsible and remunerative opening, where versatility, initiative and enthusiasm would promote advancement. 7½ years experience includes: shops, radar, servo-mechanism and heat-transfer equipment, design and development, coupled with D.O. routine and sales and production liaison work. Also two years part-time lecturing in England. Would travel and learn French. Offers, preferably from Toronto, Montreal or Hamilton gratefuly acknowledged. Apply to File No. 3835-W.

CIVIL ENGINEER. University of Toronto 1950, Jr.E.I.C., P.Eng. Single, age 24. Past experience in surveying and highway construction and presently employed by steel fabrication company. Desires more progressive position with structural consulting firm or industrial organization. Southern Ontario or Montreal area preferred. Apply to File No. 3836-W.

Public Utility Requires

Professional Engineer for Assistant Superintendent of Steam Generating Station. Experience required in operation of pulverized fuel fired boilers, and steam turbines in 20 to 30 thousand kilowatt range, 600 p.s.i.g., 815 degree steam conditions. Two machines now in operation, and two on order for operation in 1953 and 1955 to meet rapidly growing load.

Apply in writing to Mr. N. T. Smith, Manager Nova Scotia Light and Power Company, Limited.

INDUSTRIAL ENGINEER, B.A.Sc., U. of M., M.A.Sc., (Industrial Organization) U. of T., Jr.E.I.C., age 25, bilingual, with 2 years experience in time and motion study, cost control and incentive plan, and production planning. Interested in working with any industry on development of time standards and new methods. Actually with a firm in Quebec but available on short notice. Apply to File No. 3837-W.

CIVIL ENGINEER, Jr.E.I.C., 25, 1947 graduate, 5 years with consulting firms in structural design of a large variety of industrial buildings, power plants and other structures in reinforced concrete and structural steel. Interested in responsible position with any firm engaged in the design or construction of industrial or commercial buildings, or or hydro-electric, municipal, or similar work. Will also consider part time work. Apply to File No. 3838-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., age 30, married, ex-senior officer R.C.A.F. Experience includes design, draughting, estimating, plant layout and maintenance. Interested in obtaining position as plant engineer or assistant. Apply to File No. 3839-W.

PROFESSIONAL ENGINEER recently arrived from England, 8 years experience in contracting and manufacture of electrical equipment in technical and administrative positions seeks employment in Toronto preferably where intelligent hard work and initiative will lead to advancement. Details and excellent references supplied on request. Apply to File No. 3840-W.

DO YOU HAVE TROUBLE getting drawings out on schedule? If so, let us help you. Engineer draughtsmen Jr.E.I.C. in Montreal available for part time work in structural and lighting layouts, wiring diagrams, etc. Apply to File No. 3841-W.

CIVIL ENGINEER, B.Sc. (Saskatchewan, 1950), S.E.I.C., age 29, married, one child. Diverse experience in construction, administration, hydraulics and hydrology. Interested in obtaining a position in a city or municipal engineers department preferably in Western Canada. Presently engaged in hydraulics and hydrologic work. Available in one month's notice. Apply to File No 3842-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., desires part time work (evenings) in Montreal. 3 years experience in reinforced concrete design. Apply to File No. 3843-W.

EXPERIENCED CONSTRUCTION ENGINEER, B.A.Sc., P.Eng. (Ont.), desires

part time work in design, draughting, quantity take-off and cost estimates of building foundations. Apply to File No. 3844-W.

CIVIL ENGINEER, B.Eng. (McGill, 1949), P.Eng., Jr.E.I.C., age 25, married. Four years experience on reinforced concrete design and construction, transmission line surveying, tower design and manufacturing inspection, desires position with consulting engineering firm in Montreal area. Apply to File No. 3845-W.

THIRD YEAR student in Civil Engineering at the University of British Columbia would like a position with consulting or contracting engineers during the coming summer. Speak and write: Greek, Arabic and get along with French. Age 22 and will be available on May the 15th, 1952. Apply to File No. 3846-W.

CHEMICAL ENGINEER University of Toronto, 1950, Jr.E.I.C., member A.P.E.O., age 22, single. Two years industrial experience in the production of sandpapers and development and control work in the production of protective coatings and allied products. Desires position with firm, preferably in the Toronto area, where hard work and initiative will bring advancement. Available immediately. Apply to File No. 3848-W.

MECHANICAL ENGINEER, S.E.I.C., Manitoba, 1951. 5 years apprenticeship in the railway industry, 2½ years mechanic in the R.C.A.F., age 28, single. Desires position in the Industrial engineering field offering the opportunity for training and advancement. At present working on research problems in the railway mechanical field. Ontario or Western Canada preferred. Apply to File No. 3852-W.

ELECTRICAL ENGINEER, McGill, 1950, Jr.E.I.C., test course graduate of large electrical firm with experience in design and related production problems. Desires position of increased responsibility with progressive organization. Married with two small children. Apply to File No. 3859-W.

SPARE TIME WORK: Civil Engineer, M.E.I.C., seeks spare time design work in structural steel, reinforced concrete or prestressed concrete, Toronto area. Apply to File No. 3860-W.

CONSULTING ENGINEER now established in the Maritimes is desirous of representing engineering or sales engineering firms in the four Maritime provinces. Graduate civil engineer, M.E.I.C., well known by engineering people and travels throughout the area. 48 years of age. Apply to File No. 3861-W.

MECHANICAL ENG., D.L.C., Jr.E.I.C., British Grad. 1948, single. Familiar with workshop processes, 18 months hydraulic research and tests in Canada. Seeks responsible position. Location irrelevant. Available on two weeks notice. Apply to File No. 3862-W.

ASSOC. MEMBER INSTITUTION of mechanical engineers (British), Dipl. Eng. (Warsaw University), naturalized British subject, age 45 with 20 years experience in development of various types high speed internal combustion engines (carburettor, petrol-injection, diesel, super-charged, etc., from 20 to 1,000 H.P.), at present chief Research Engineer in a large motor manufacturers in G.B., desires position in Canada. Knowledge of French. Apply to File No. 3863-W.

GRADUATE CIVIL ENGINEER Jr.E.I.C., 3 years experience in reinforced concrete design, knowledge of prestressed concrete, also structural steel, desires responsible position with possibilities of advancement with a construction firm in Montreal. Available on 2 weeks notice to present employer. Apply to File No. 3864-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.A.Sc., University of Toronto, 1948, 3½ years design experience in the pulp and paper industry. Plant layout, maintenance and general engineering. Presently employed. Desires a position with opportunity of advancement. Age 28, married. Southern Ontario, Toronto area preferred. Apply to File No. 3865-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., Ontario, B.A.Sc., University of Toronto 1946, seeks foreign employment in construction field. Experience includes field work in surveying and heavy construction, particularly the erection of steel structures, and office work in all phases of detailing, designing, estimating, and erection of steel structures, as well as general plant layout, reinforced concrete and timber design. Particularly interested in problems of management in engineering enterprises. Married, available September, 1952. Apply to File No. 3866-W.

STRUCTURAL ENGINEER, M.E.I.C., P.Eng. (Alta. and Sask.), B.Sc. (Civil), Manitoba, 1947, age 29, married, no children. Presently suitably employed but seeking position with firm of architects or consulting engineers in Vancouver. Available 2 months notice. 5 years experience in all types of construction in steel, reinforced concrete, and timber. 3 years in complete charge of design of multi-storey office buildings, warehouses, schools, etc. Also experience in supervision of personnel in drafting room, field supervision of contractors, specification writing, cost analysis, site surveying, etc. Responsible for all phases of construction from foundations to superstructure. Desire responsible position as senior designer. Apply to File No. 3867-W.

BRITISH ENGINEER, 35, married, B.Sc., A.M.I.M.E., P.Eng. (mechanical and industrial), worked as: research, development, consulting engineer, experience: combustion, heat exchangers, fuels, refractories, instruments, furnaces, mechanical handling, welding, machine design, plan lay-out, cost evaluation; proved administrative and organizing ability, desires responsible position. Available at one month notice. File No. 3885-W.

SALES ENGINEER, Jr.E.I.C., P.Eng., B.Sc., from M.I.T. in 1951 in chemical engineering. Engineering education includes business and economics, experience includes industrial and mechanical sales to the expanding construction and chemical industries. Desire chemical or mechanical sales position with opportunity and future. Presently located in Montreal but willing to travel. Apply to File No. 3886-W.

CIVIL ENGINEER, B.A.Sc., M.S.E., M.E.I.C., R.P.E., desires position as City Engineer of City Commissioner. Is twenty-nine years old, Member of Provincial Board of Health, Member of Technical Committee Revising National Building Code, a Director of Division of Sanitary Engineering, a Director of Western Water and Sewage Conference, and a Lecturer at University. Wide experience in design and financing of municipal utilities. Proven ability in Public Relations. Initiative shown by recent technical publications, school for municipal engineers and foremen, reduction of municipal fire insurance rates, activity in community planning, etc. Will not be available for service until August 1952, at earliest, but can make arrangements to visit city and discuss position beforehand. For further particulars apply to File No. 3892-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., married, presently employed Six years service in pulp and paper industry. Supervising experience and ability to organize. Familiar with mill maintenance and repair work, mill construction, budget and planning. Three years as engineer officer afloat in R.C.N.V.R. Would like responsible position in industry with opportunity for advancement. Apply to File No. 3870-W.

MECHANICAL ENGINEER, M.E.I.C., widely experienced in design of material handling squipment, cranes, crane runways and structural steel, willing to take short term contract with any firm planning a material handling system for their own plant. Will undertake design, field work, estimating and installation. Apply to File No. 3872-W.

CHEMICAL & METALLURGICAL ENGINEER, M.A.Sc., Jr.E.I.C., U. of Montreal, 1947-1948, married, bilingual, with research and development experience in heavy chemicals, plant design and installation. At present employed with the Govt. of Canada in the chemical treatment of radioactive ores. Has gained experience in the electrochemical field and has supervised field installation of large chemical and metallurgical plant. Desires greater responsibilities in research or production within the expanding Canadian industry. Apply to File No. 3873-W.

GRADUATE ELECTRICAL ENGINEER, M.E.I.C., P.Eng., also graduate of the General Electric Test Course experienced with Public Utility problems, especially administration, operation and maintenance and preliminary design of Hydro Electric developments. Would consider any position leading to increased responsibility. For further information apply to File No. 3893-W.

CIVIL ENGINEER and Land Surveyor, M.E.I.C., B.Sc. (Manitoba, 1945), M.L.S. (1947), age 28, seven years experience in higher surveying, base line and township outlines, special surveys, subdivision surveys, checking plans of survey. Desires position in survey or city planning office or engineering office involving knowledge of higher mathematics and legal descriptions. Available on one month's notice. Apply to File No. 3894-W.

CHEMICAL ENGINEER, 1951, graduate, 31, single. Sixteen months research in wood chemistry, one year production control and technical service on phenalic and area synthetic resins. Desire position with organization with a good training plan, or as an assistant to an experienced engineer. Apply to File No. 3895-W.

MINING ENGINEER, B.Sc., Jr.E.I.C., three years of experience. Presently employed. Desires position in mining in the Province of Quebec. Apply to File No. 3896-W.

CHEMICAL ENGINEER, University of Alberta 1949 graduate, war veteran, married, 36 years old. Employed since graduation as assistant to chemical engineer supervising operation of large municipal water treatment plant employing cold process lime soda softening and boiler water treatment in allied 60,000 KWH high pressure power plant. Available on two months notice. Apply to File No. 3897-W.

TWO MECHANICAL ENGINEERS, S.E.I.C., desire part time work, evenings and week-ends. Estimating, designing, drafting. Apply to File No. 3898-W.

MECHANICAL ENGINEER, M.E.I.C., age 37, married, 3 children. Experience in production and maintenance of mechanical equipment and also sales and service of automatic controls. Speaks and writes fluently both French and English. Presently has own company. Desires responsible position as assistant to senior executive, requiring methodical thinking and the ability to get on well with those above and below him. Would also consider sales engineering offer. Apply to File No. 3899-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., desires part time employment in Montreal for evenings and week-ends. Detail design, draughting, tracing. Experience, maintenance of diesel engines, detail design and draughting in centrifugal pumps, tracing of piping layouts and power plant installations. Apply to File No. 3900-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.Sc. (Dal '40), B.E. (N.S.T.C. '43). Business Correspondence course, age 36, married, one child. Interested in maintenance and distribution with utility or medium size company with an opportunity to work into administration position. Experience includes four summers dockyard expanding electrical system, one summer Arvida construction, test course, three years consulting firm—heating, lighting, electrical and plant layouts and cost systems, four years hospital and X-Ray maintenance in China. Available immediately. Apply to File No. 3901-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950, University of Saskatchewan graduate. Married, veteran, age 27, one year of industrial design and draughting experience. Presently employed in Eastern Canada but interested in mechanical and engineering openings in the province of Alberta. Available on short notice. Apply to File No. 3902-W.

MECHANICAL ENGINEER, S.E.I.C. (N.S.T.C. '51), age 23, single. Employed four summers while undergraduate with manufactured gas company. Since graduation have been employed with a small prepane bulk plant. Desire change of work, will consider anything. Available on short notice, no location preference. Apply to File No. 3903-W.

MECHANICAL ENGINEER, University of B.C., 1948, wishes to relocate in or near Vancouver. Four years experience in design, layout, and installation of light and heavy machinery; production problems; and development engineering. Will be available for interview in Vancouver late June. Apply to File No. 3904-W.

News of the Branches

Activities of the Thirty-seven Branches of the Institute and abstracts of papers presented at their meetings

Belleville

C. H. Lusk, jr.e.i.c.,
Secretary-Treasurer

March Meeting

Fifty-two members and guests were present at a meeting of the Belleville Branch which was held at the Masonic Temple on March 10th.

In the absence of Mr. E. G. Gurnett, Vice Chairman G. A. Bradford presided.

Mr. Bradford announced that the April meeting would take the form of a social night, and would include the election of officers for the new year.

Mr. F. C. Adsett then introduced the speaker, Mr. H. G. Young, who addressed the Branch on *Radio in the Telephone Industry.*

Mr. Young outlined the history of Canadian use of radio in the telephone industry, the advanced use of high frequencies by the Bell Telephone Company, and the proposed use of new high frequency facilities by C.B.C. for television. He then devoted a few minutes to a review of the various frequencies employed. In transmitting voice by telephone, a range of frequencies from 200 cycles per second to 3200 cycles is used. Television, however, will require a band width of 3 megacycles or 3 million cycles. It would be possible, therefore, to put 600 telephone circuits on the band of frequencies required for television. Mr. Young pointed out that as the frequency is increased, the wavelength of the radio wave is decreased. Television programs will be transmitted from Toronto to Montreal by a system of towers at a frequency of 4,000 megacycles. At this frequency the radio waves travel in a straight line and are not reflected or deflected as in the case of standard radio broadcast. No noise or static is encountered at this frequency as no static has a frequency of more than 1,000 megacycles.

In order to transmit television programs for the C.B.C., the Bell Telephone Company will construct a series of towers and relay stations between Buffalo, Toronto, Ottawa, and Montreal. The average spacing between these towers will be 27 miles. Tower heights will vary from 50 ft. to 225 ft. A tower to be located near Stirling will be 120 ft. in height. These towers vary in height in order to obtain a clear line of sight between towers and at the same time keeping the height to a minimum for more economical construction.

There will be four antennae on each tower measuring 10 ft. square and 10 ft. deep. This will provide four frequency channels, one for television transmission from Toronto to Montreal, one for television from Montreal to Toronto, and two for telephone circuits. These towers and relay stations will be unattended and therefore in order to provide adequate protection, automatic alarm circuits for 42 different types of emergency or failure of equipment will be centered in Kingston from each relay station between Toronto and Montreal.

It should be noted that there is no provision for the transmission of television programs to home receivers in the immediate vicinity of these towers. The sole purpose is to transmit television programs from Toronto to Montreal or vice versa for transmission by the C.B.C. from either centre to the individual home receiver.

Mr. Young concluded his address by presenting a short demonstration of the characteristics of ultra high frequency waves. For this purpose he used a small 10,000 megacycle transmitter and a similar receiver. He demonstrated that an insulator such as dry wood has no effect on the transmission of the waves but that a conductor such as brass will block the transmission. The manner in which a wave guide will bend the microwaves and the effect of polarization was also demonstrated.

The appreciation of the Branch was expressed by Mr. S. Sillitoe.

Border Cities

W. A. McDougall, m.e.i.c.,
Secretary-Treasurer

"Canada's capital expenditure to date on the St. Lawrence-Great Lakes Navigation route, expressed in terms of today's dollar, is at least one billion dollars." So stated Guy A. Lindsay, director of the Special Projects Branch of the Department of Transport to members of Border Cities Branch of the Institute on March 13, 1952, in Windsor, Ont. He said that to date, Canada's capital investment in the present Waterway amounted to nearly $300 million and those of the United States $93 million. "The significance of these figures can be appreciated when it is realized that over 50 per cent of Canada's expenditures were made during the period when our population was less than 75 per cent of what it is today and when our construction dollar represented about four times the value of today's dollar."

Mr. Lindsay said that the cost of the navigational works on the Canadian side of the International section of the river would be about $35 million more than similar works on the United States side as envisioned under the joint undertaking. Required channel enlargements below the lower entrance to the proposed canal extending from the town of Mille Roches to above the City of Cornwall would be responsible for most of this additional cost.

A close student of the engineering problems of the St. Lawrence River over the past thirty years, Mr. Lindsay stated that it was not generally appreciated "what a remarkable power stream the St. Lawrence is." He said that at the present time, the overflow from Lake Ontario" is controlled by the depth of water on the natural rock sill extending across the river at the head of Galop Island, situated a few miles below Prescott."

The proposed improvement of the International Section of the St. Lawrence, said Mr. Lindsay, "entails the removal of this natural rock sill control, thereby necessitating the control of the outflow by the manipulation of gates in the control dam at Iroquois, in the Long Sault dam and at the power houses." Under this control, he said that the range between minimum and maximum levels of Lake Ontario would be considerably reduced.

Mr. Lindsay also outlined the means proposed for reducing the velocity of the water in the river during the ice forming period to make possible "the satisfactory operation of the power plants in the International Section and at Montreal."

Outlining the power possibilities of the project, Mr. Lindsay pointed out that "as a source of hydro electric power, the Great Lakes System is unsurpassed." From an average outflow from Lake Superior of 77,000 cubic feet of water per second, the run-off increases to an average of 202,000 c.f.s. down the Niagara River and to 237,000 c.f.s. from Lake Ontario." He also said that the maximum outflow from Lake Ontario has been about 314,000 c.f.s. but at Lachine the maximum is about 480,000 c.f.s. with the Ottawa River contributing 40 per cent of its total flow into Lake St. Louis.

Speaking as an engineer, Mr. Lindsay told members of the Engineering Institute of Canada that approximately 50 per cent of the total expenditure required in the construction of the seaway and power development would be on excavation and concrete. He estimated that "the removal of approximately 136 million cubic yards of earth and rock will be required and the placing of about 6½ million cubic yards of concrete will be necessary."

Calgary

C. E. McNiven, m.e.i.c.,
Secretary-Treasurer

P. M. Sauder, m.e.i.c., was awarded life membership in the Association of

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Professional Engineers of Alberta, on February 1st, at a dinner of the Association and the Calgary Branch of the E.I.C.

T. D. Stanley, chairman of the Calgary Branch of the Institute, made the presentation address on behalf of the Association. He reviewed the career of Mr. Sauder from the time in 1905 when he made the first rating of the Bow River at Seebe, which started a most important chain of events.

After many years with the Irrigation Branch of the Department of the Interior, he was active in irrigation work in Alberta, principally as manager, from 1924 to 1941, of the Lethbridge Northern Irrigation District.

In 1941 he received the appointment of director of water resources for the Province, from which he retired in 1944 to become general manager of the Western Irrigation District at Strathmore, at the same time still keeping his eye on irrigation in the Lethbridge area.

In 1947 Mr. Sauder was appointed manager of the St. Mary River Development by the Dept. of Water Resources, and in 1950 his ability to combine pure engineering with the human factor was recognized by the Alberta Government with his further appointment as colonization manager of this development, which includes the new St. Mary Development and the old A. R. & I. He moved to Lethbridge at that time, remaining as consultant to the Western Irrigation District.

On many occasions during these busy years, Mr. Sauder represented Alberta's interest before the International Joint Commission and played no small part in assuring Alberta's share of the International Waters.

He has been a member of the Alberta Power Commission since its formation in 1944.

During all this time Mr. Sauder has been a very active mainstay in both the Institute and Association affairs. P.M. became a member of the Institute in 1904 and the Association at its inception in 1920, after having been active in the formation of the Association.

His activity totals up to 22 years of service in the Association. Mr. Sauder was very active in working out the joint Agreement with the Engineering Institute of Canada and has been the only representative the Association has had on the Council of the E.I.C., which position he still holds. He has held numerous offices in the Institute and has always found the time and energy to give his best to the many, many committees he has served on in both organizations. The number of times he has been called upon to act on committees clearly indicates his ability, interest, integrity and the confidence which fellow engineers place in him. In this busy life Mr. Sauder found time to marry a charming wife and to raise an accountant, an engineer and a dietitian, who are known to many of you.

Mr. Stanley concluded by addressing Mr. Sauder directly in the following terms: "Mr. Sauder, in recognition of your work as a pioneer engineer in the development of this Province, your untiring efforts as a member of the Engineering Institute of Canada and your signal service to the Association of Professional Engineers of Alberta, I, on behalf of the Association, have the honour to present to you this Life Membership in the Association of Professional Engineers of Alberta.

"Here is an engineer this Association is proud to recognize."

February Meeting

Dr. David Lander gave a talk to the Calgary Branch on the evening of February 14, 1952, which was unique in several respects. The subject of his talk was **Mind Over Matter** in which Dr. Lander described the close relationship between the mind and the malfunctioning of the main glands and organs of the human body. His talk was a down to earth chat between a medical man and laymen and delivered in a manner which was non-technical and interspersed with wit and sly digs at the neurotic-minded.

Speaking of stomach ulcers and colitis he said that these conditions were a result of "not what you ate so much as what was eating you", and it is necessary to treat the mind rather than the stomach to effect a cure.

Dr. Lander's talk was interspersed with mirth provoking stories which gave point to his outline of psychosomatic medicine as seen through the eyes of a general practitioner.

When a person was told that his trouble was emotional, the doctor did not mean that it was imaginary, but that a happy person with an allergy would not be affected by it, while an unhappy or mentally disturbed person with an allergy would often be seriously ill.

Ladies Night

Friday, February 29, 1952, was "Ladies Night" for the Calgary Branch. A goodly crowd of 160 members, wives and guests gathered at the Al San Club for an evening of bridge, dancing, and social visiting between friends who do not have many such opportunities to get together at other times during the year.

Guests and members and the ladies were welcomed by Mr. H. R. Hayes, chairman of the Branch, and by Mr. H. Randall, president of the Association of Professional Engineers of Alberta.

Following an enjoyable evening, lunch was served at 11.00 p.m.

Central British Columbia

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

Dinner Meeting, March

A meeting on March 14, in the form of a joint dinner meeting with the B.C. Engineering Society, was held at the Legion Hall at Kelowna, with 31 attending.

The general business meeting of the E.I.C. was held directly after dinner, with H. Hatfield in the Chair, and M. L. Zirul acting as secretary in the place of H. Topham.

The Chairman expressed the hope that as many members as possible would attend the Annual Meeting of the Institute in Vancouver, May 7th to 9th. Details would be circulated from Montreal Headquarters in the usual way.

The meeting received progress reports of the various working committees. The chairman announced changes and additions to membership.

The acting secretary presented a few notes on "Advantages of Membership in the Engineering Institute of Canada".

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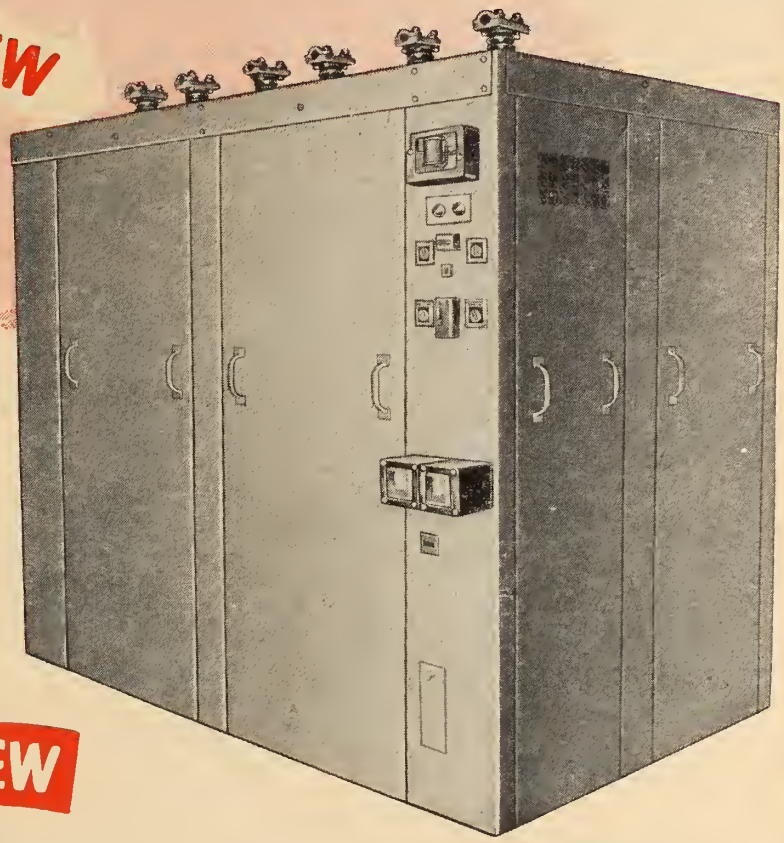

This continent's first Air-cooled Step Voltage Regulators are strictly a Canadian development — a product of Canadian Westinghouse engineering to meet the needs of Canada's utilities. Designed for indoor use, Westinghouse dry-type feeder-voltage regulators can handle up to 15 kilovolts, and are now in field service, after the equivalent of years of successful operation on test.

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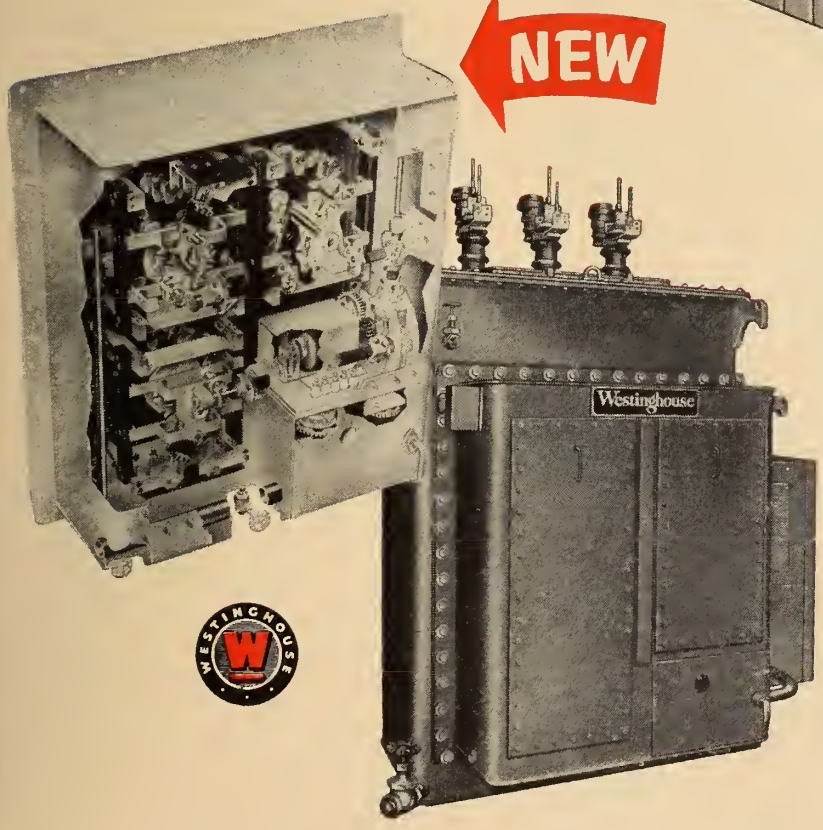

Westinghouse are able to supply the newly developed dry-type as illustrated above, and as well can supply the more conventional Oil immersed regulator shown with new and improved Westinghouse type URS tapchanging unit. Available in 3 phase for 750 KVA and below, and in single phase for 250 KVA and below, up to 69,000 volts, the standard type URS has regulation up and down in 5/8% or 1 1/4% steps — direct mechanical drive — Geneva gear action of moving parts and self-contained control circuits.

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after which the E.I.C. meeting adjourned. The business meeting of the B.C. Engineering Society followed, with H. Hatfield presiding and N. Trouth acting as secretary.

The speaker of the evening, Mr. Allan Moss, S. M. Simpson Ltd., Kelowna, was introduced by Allan Ker. Mr. Moss gave a most interesting paper on **Forest Management** as pertaining to the world in general and B.C. in particular. A series of photos were projected, showing forest management at work, as practiced in Sweden.

A note of thanks was proposed by Mr. O. Walker on behalf of both groups.

Cornwall

JOHN A. SARJEANT, JT.E.I.C.,
Secretary-Treasurer

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

Dinner Dance

On March 14th, an enjoyable dinner dance was held at the Cornwallis Hotel. The guest speaker was Dr. J. A. Phillips, chairman of the Cornwall and Suburban Planning Board who spoke on the subject **Planning Cornwall for the St. Lawrence Seaway and the Future.**

Dr. Phillips presented some of the problems faced by the planning board in laying plans for highways in this district. He stressed that the board would appreciate a report from the local members on the proposed highway locations, as this is of great importance to industry and also to private home owners.

The speaker briefly traced the history of the Cornwall area from the first settlement by the United Empire Loyalists until the present. He pointed out some of the factors regarding the subdividing of the district, which are creating today's traffic problems and the difficulty in establishing satisfactory zoning by-laws.

The indecision regarding the exact location of the seaway project and when the construction will start, is making the work of the board difficult. He outlined various proposed locations for the seaway, but stated its exact location is still "very indefinite".

Dr. Phillips was introduced by A. S. Holder, vice chairman of the branch and thanked by Drummond Giles, vice-president of the Institute.

B. T. Yates, chairman of the branch, outlined the aims and policies of the Institute for the benefit of the many guests present. He also stated that the junior member post graduate course being conducted by the Cornwall Branch has been much more successful than anticipated.

Hamilton

J. A. REID, JT.E.I.C.,
Secretary-Treasurer

B. A. WARREN, JT.E.I.C.,
Branch News Editor

February Meeting

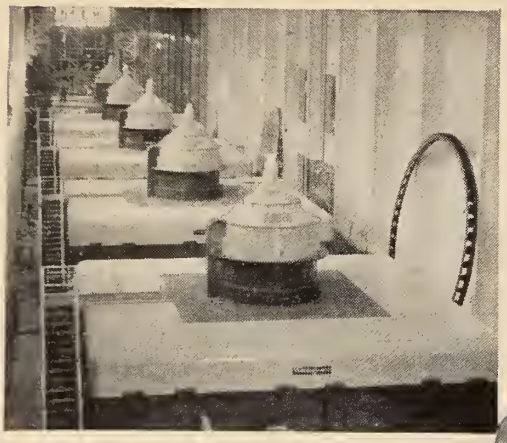
A crowd of over 200 engineers jammed the Mills Library Auditorium of McMaster University on Thursday, February 21, to hear Dr. John W. Mauchly deliver a sparkling and informative address on **UNIVAC, The Electronic Brain.**

Dr. Mauchly, of the Eckert-Mauchly Computor Division: Remington-Rand, has already made a distinguished name for himself in the field of electronic computing machines, being recognized as one of the top men in this field. To the group in attendance he made the subject of the Brain, its construction, operation, and principles, if not simple, extremely clear; and in so doing, he impressed his audience with his grasp of this highly scientific field.

Dr. Mauchly, although "realizing that all things cannot be said in one evening about the computor (not even all the true things)," gave the group an excellent story of the machine. He claimed that his company, instead of attempting to build bigger and better electronic computors, was working to build smaller and better machines. His UNIVAC is the only computor of which there are more than one in existence.

The speaker deplored the fact that there are perhaps one hundred different companies engaged in the construction of electronic computors, each one, although finally developing the type best suited to his needs, going over the same general groundwork in one of a hundred different methods.

He explained by the use of excellent slides, the method of feeding problem data to the machine and taking off the answers by means of tapes, and teletypes. He also told how there are prob-



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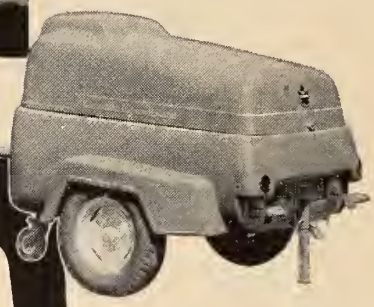

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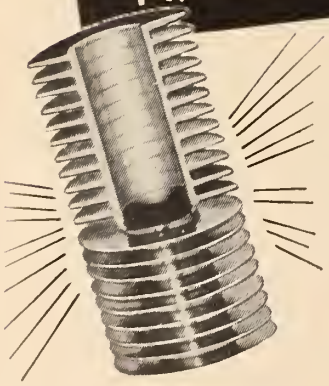

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lems of a statistical nature which can have an extremely high input of information and produce a very short answer in the form of a percentage breakdown for example. Similarly in the design of an aircraft wing, thousands of digits can be fed into the machine which finally comes up with the answer plus or minus, yes or no. The wing is either satisfactory, or it will fail.

In all the many millions of computations made by these electronic computing machines, it has been impossible to lay one error at the feet of the machine itself. By means of systematic maintenance, the machine can be made to do no wrong.

Dr. Mauchly went into details of the memory part of the machine's mechanism, telling how it is able to hold digits by means of waves stored in a mercury tube circuit. He stressed the fact that the prime purpose of the machine was to save man-hours of labour. In the case of the U.S. Bureau of Census, one of these UNIVAC Electronic Computors is in use, and it has cut the manual work of that Bureau in half.

Dr. Mauchly's presentation of his subject was of the highest calibre and his slides were excellent. His talk aroused an enthusiastic discussion period following the formal delivery.

The speaker was introduced by Mr. S. S. Schneider, manager of the Electronics Division of the Canadian Westinghouse Company, and was thanked by Mr. W. J. W. Reid, president of the Otis Elevator Company.

Branch Chairman W. L. Hutchison asked the various committee chairmen to stand for introduction to the meeting. They are: Messrs. W. A. Dawson, Program; E. Jorgensen, Membership; D. J. Haines, Attendance and Phone Squad; A. W. S. Tite, Budget; J. S. R. Beck, Students and Juniors Papers Competition; C. P. Layard, Students and Juniors Course in Professional Development; B. A. Warren, Publicity (Pro tem); J. A. Reid, Secretary-Treasurer.

Hamilton Branch Committees

At a recent meeting of Engineer's Ball committee of the Hamilton Branch, it was recommended that last year's Ball treasurer and vice-chairman Mr. W. A. Wheten, be appointed to the position of Ball chairman for the coming year.

At an executive meeting of the Hamilton Branch of the E.I.C., Mr. W. A. Dawson presented a report on the possibilities of establishing an Engineer's Club in Hamilton. Mr. E. T. W. Bailey, past chairman of the Hamilton Branch is to take over the chairmanship of this Engineer's Club committee to carry out further research in this field.

Mr. J. H. Mitchell and Mr. W. E. Brown were appointed at a recent Hamilton Branch executive meeting to investigate the possibilities of the Branch assisting local secondary schools in the field of vocational guidance for youths interested in engineering as a career.

Lethbridge

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

J. T. Dokken, jr.e.i.c.,
Branch News Editor

February Dinner Meeting

The Lethbridge Branch of the Institute held a dinner meeting at the Marquis Hotel on Saturday, February 16th. P. E. Kirkpatrick presided as chairman. Mr. L. G. Grimble, bridge engineer for the Alberta Government, the speaker, had chosen as his topic **Bridge Construction in Alberta.**

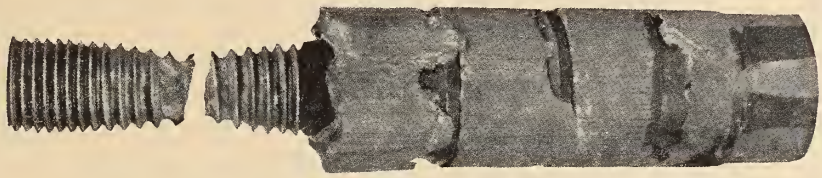
The Brown Instrumental Trio supplied delightful dinner music. G. S. Brown led in community singing after which he presented a floral gift to Mrs. Katherine Brown in appreciation of the many years of faithful service the Brown Trio has given to the Lethbridge Branch.

M. S. Mitchell introduced the speaker. Mr. Grimble stated that there are 10,000 bridges in Alberta, a greater number per capita than in any other province. This is due to the numerous mountain streams originating in Alberta and also to the method of land surveys used. In Alberta any stream crossing of 16 feet or greater is called a bridge, all others are culverts.

The Alberta Highway Bridge Department is responsible for both municipal and highway bridges. This centralization allows for the purchase of materials in large quantities and for standardization of design and equipment.

Mr. Grimble stressed the following six phases of bridge construction.

1. Layout.
2. Preliminary investigations and stream study. Most investigational work is being done today, at a great saving, with the help of aerial photographs. Up to the present time, stream studies have not been too extensive.



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3. Economic analysis and type selections. This phase is very important in that it gives the greatest possibilities for savings. The through truss is becoming obsolete and is being used today only on little used roads. The deck type truss or girder bridge, coming to the fore, involved from 15 per cent to 20 per cent less weight of steel. Treated timber and precast concrete are being used extensively for small bridges in Alberta.
4. Detail design and checking. In Alberta a combination of American and Canadian specifications are used.
5. Construction.
6. Maintenance.

As an indication of the growth of the department within the last six years, the appropriation in 1951 was $4 million spent mostly on bridge construction. In 1945 approximately one-quarter million dollars was appropriated and the work done was predominantly maintenance of bridges. Last year over 800 bridges were repaired and from 300 to 400 bridges are being built per year.

The speaker explained the difficulty in planning bridges for the future. Loadings, traffic densities and routes are continually changing; new materials are coming into use all the time. In the opinion of the speaker, precast and prestressed concrete will be used extensively in future Alberta bridges.

After an enlightening question period a film depicting the construction of America's first prestressed concrete bridge in Philadelphia was shown.

N. D. Bradley moved a vote of thanks on behalf of all present to Mr. Grimble for his informative talk and film.

London

R. G. Newell, Jr.E.I.C.,
Secretary-Treasurer

I. D. Patterson, M.E.I.C.,
Branch News Editor

March Meeting

The March meeting of the London Branch was held in Wolseley Barracks Reserve Force Officers' Mess on Tuesday, March 18. The guest speaker of the evening was Mr. W. F. McMullen, manager of technical personnel, Canadian General Electric Company, and his subject was **Building the Young Engineer from the Ground Up.** More specifically, Mr. McMullen dealt with how C.G.E. builds the young engineer.

Young engineers hired by C.G.E. are given their famous two year test course. During the first year, their progress is assessed every three months, and every six months in the second year. Every new engineer is assigned to an older engineer to whom he can turn for guidance and advice. They are required to write reports or essays every six weeks on the departments in which they are located. Assessments of the young engineers' progress are made once a year after leaving the test course. All relevant information on the engineer is filed, and advancements are made accordingly.

A short, formal discussion period followed, and Mr. Gordon Jarvis thanked the speaker.

Vice-chairman I. D. Patterson acted in Chairman D. McGeachey's absence. Coffee and sandwiches were served. The meeting was attended by approximately thirty-five members.

Lower St. Lawrence

Jean R. Menard, M.E.I.C.,
Secretary-Treasurer

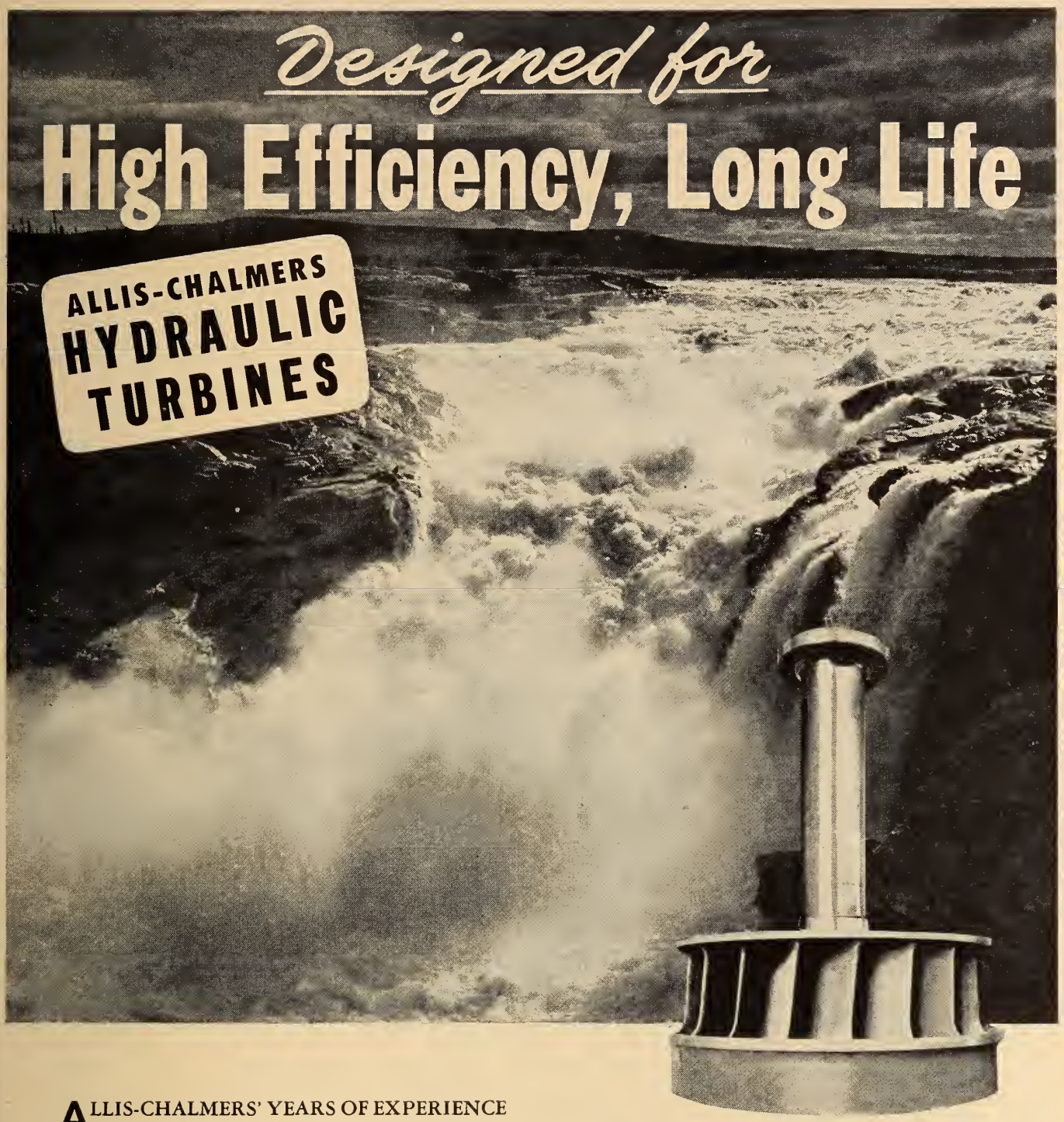
Jacques Vachon, Jr.E.I.C.,
Branch News Editor

Annual Social Meeting

The engineers of the Lower St. Lawrence region, their wives and guests had a rendezvous at the Hotel St. Louis, Rimouski, for the first social meeting of the Lower St. Lawrence Branch, on February 16, 1952.

A group of 50 came to the rendezvous. A cocktail was served at 7.00 p.m., followed by a dinner presided over by Mr. Leo McLaren.

Mr. Jacques Brillant, the guest speaker, introduced by Mr. Thomas Bernier, gave an interesting talk on the ways and customs of some European peoples. With much time spent overseas, his personal contacts and a keen sense of observation, Mr. Brillant was well qualified to relate some interesting particularities of these peoples. The much-travelled speak-



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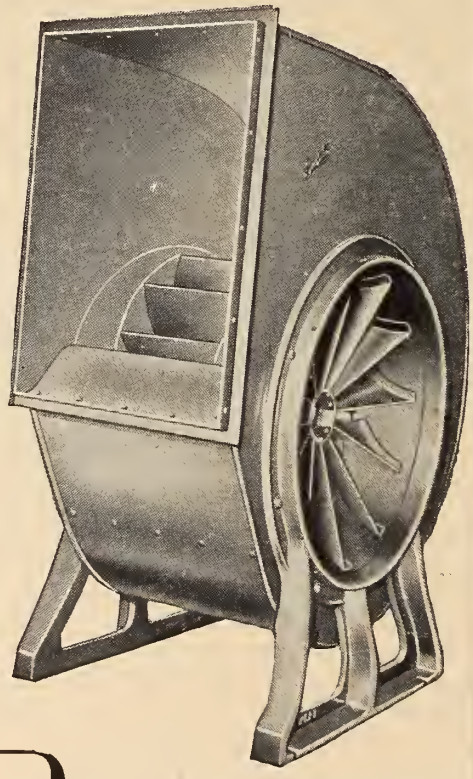

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er captivated the mixed audience with appropriate and humorous remarks.

Mr. Jacques Vachon expressed a vote of thanks to Mr. Brillant on behalf of all present for his enjoyable talk.

After dinner, the guests remained for the social evening and all those in attendance considered the gathering a truly successful one.

January Dinner Meeting

The newly formed Lower St. Lawrence Branch of the Institute held its second monthly meeting at the Georges VI Hotel, Rimouski, on January 31, 1952.

Mr. Leo McLaren acted as chairman of the meeting and three junior members gave after dinner talks.

Mr. Marcel Fradette, introduced by Mr. Gabriel Gagnon, discussed proposed improvements to the Matane harbour. Mr. Fradette explained how the Matane River could be diverted to prevent silt deposits in the harbour.

The second speaker, Mr. Andre Leroux, was introduced by Mr. Jacques Vachon. According to Mr. Leroux's analysis, it is economically unsound to build a home with the present high cost of materials and labour if living quarters can be rented.

The third speaker, Mr. Andre Michaud, introduced by Mr. Cecil Doak, described the rapid growth of the Corporation de Telephone de Quebec in recent years and demonstrated how this communication system in the Lower St. Lawrence region is improving its services in spite of the difficulties of terrain and distances.

Montreal

R. B. Wotherspoon, M.E.I.C.,
Secretary-Treasurer

Junior Section

Leo J. Hammerschmid, Jr.E.I.C.,
Secretary-Treasurer

Open Forum

On Monday, March 24, the Junior Section held an Open Forum on Engineering, which was designed to take the form of a "Beef Session". The attendance was well over 200 members and guests.

The Forum was organized as an attempt to clarify the position of the Junior Engineer, to clarify the purpose of the Institute, and of the Corporation, and primarily to give the members and guests a chance to air their views on the question of a shortage of engineers by means of an open discussion period.

Invited to speak on the panel were J. B. Stirling, Leopold Nadeau, Guy Montpetit, Warren Maciver, and L. Austin Wright.

Dr. Stirling, vice-president of the Engineering Institute, spoke on "What the E.I.C. can do for me". He outlined his association with the Institute from the time he graduated some 40 years ago, until to-day, and showed how this association had helped him to make friends and contacts in the business world. He urged young engineers to partake in the Institute's activities, and pointed out the valuable training this afforded the individual.

Mr. Nadeau, general secretary of the Corporation of Professional Engineers of Quebec outlined the functions of the

(*Continued on page 393*)

BRANCH NEWS

(*Continued from page 388*)

Corporation, and showed how this organization ensured the legal rights of the Engineering Profession. He pointed out that the profession as such was only 32 years old, and for this reason was not as strongly established in Canadian society as, for instance, the medical profession which has been strongly established in Canada for over 150 years. He pointed out that with the continued co-operation of all engineers, a great deal more can be accomplished in the future.

Mr. Guy Montpetit, prominent consulting engineer, spoke on "What the young engineer wants". He stated that from his experience in dealing with young engineers, he felt that security was their prime objective. What form this took seemed to differ with the individual concerned. Mr. Montpetit pointed out that when one compares the engineering profession with professions like law and medicine, one must do so on relative ground. That is to say one must compare the salary of an engineer employed by a large company to that of a lawyer employed by a large company. Furthermore, he expressed the opinion that the income of an engineer working on his own would be comparable to that of a doctor in private practice. Mr. Montpetit said that a sales engineer is just as much a professional man as is a design engineer, and that the former's technical knowledge is just as important to a company interested in selling a product as the knowledge of the design engineer who made the product. Many organizations, he said, could not function without sales engineers.

Mr. Warren Maciver, who stated that he is not a graduate, is not a member of the Institute, and is not a registered member of the profession, was asked to speak on the panel because he had shown considerable interest in the question of the shortage of engineers. He said that he did not feel that there was a shortage; and stated personal experiences to back up his point. He also outlined the position of the non-graduate in the engineering field, and advanced the thought that these individuals had much to offer to the profession through their experience.

Dr. L. Austin Wright, general secretary of the Institute, spoke on "The Overseas Engineers Project", and outlined the reasons for, and the results of, his trip to Europe. He stated that he had undertaken this trip on the invitation of the Canadian Government, that it paid all his expenses, and that he made the trip during his summer holidays. He reiterated the opinion that there was a shortage of engineers, and backed up his statement by quoting the Hon. Milton F. Gregg and the Hon. R. H. Winters, who had recently addressed the Institute on related subjects. Dr. Wright stated that the E.I.C. Employment Service has on hand some 90 requests by firms for engineers, that they cannot fill. He pointed out that while in Europe he interviewed some 200 engineers, of whom about 35 have arrived in Canada and have been placed. He stated that some individuals apparently felt that the importation of foreign engineers would lead to "flooding the market", and dealt with this point in some detail. He said that the filling of vacancies by imported engineers created new jobs for more Canadians, and that in the long run, every Canadian would gain from this.

Following these addresses from the panel, the chairman Mr. R. E. J. Layton, opened the meeting for discussion and questions from the floor. Questions were addressed mostly to Mr. Nadeau and to Dr. Wright, and dealt mainly with the legal status of engineering practice and with the problem of whether or not there is a shortage of engineers.

A summary of the discussion period would seem to indicate that a large difference of opinion exists between junior and senior engineers on the question of an engineering shortage, and opinions expressed indicated that the junior engineers were dissatisfied with their status both socially and financially.

The question period lasted almost two hours, and was adjourned at 11.30 p.m. Due to the wide interest shown in the subject and in this type of meeting, the Junior Section executive are planning to initiate a series of open discussions or debates on related subjects.

Peterborough

M. V. Powell, M.E.I.C.,
Secretary-Treasurer

J. G. Lucas, M.E.I.C.,
Branch News Editor

February Meeting

On February 27, 1952, the Peterborough Branch of the Engineering Institute of Canada held their meeting in the Public Library; Mr. G. G. McLeod of the Department of Transport was the speaker and his subject was **The St. Lawrence Seaway.** The speaker was introduced by Mr. D. A. Drynan.

Mr. McLeod stated that Canada wants the co-operation of the United States in completing the long talked about St. Lawrence Seaway, but she is prepared to undertake it alone if necessary. The St. Lawrence Seaway and power development is needed at the earliest possible date. It is important for Canadian development and urgent for National Defence. Not merely can it pay for itself in tolls as power charges but also it will bring benefits far outweighing its original cost.

The proposed St. Lawrence Seaway is a 1,200 mile channel, 27 feet or more

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deep, extending from Montreal in the east to the head of the Great Lakes in the west. Together with the St. Lawrence Ship Channel, already provided by Canada it would permit vessels to navigate more than 2,000 miles from the Atlantic Ocean into the heart of the North American continent.

Cost of added navigation facilities from Montreal to Lake Erie would be somewhat over $250 million at 1950 prices. Mr. McLeod said that while this would be a large Federal expenditure it was not beyond Canadian resources — no larger, in fact, than some past expenditures. Already Canada has spent more than $300 million in providing the Ship Channel below Montreal, the 14 foot canals into Lake Ontario, Welland Ship Canal, and the Sault Ste. Marie lock.

The St. Lawrence River is the only major source of hydro power remaining to be harnessed in southern Ontario. The need for power is so great at present that steam generators are now turning out 900,000 horsepower.

The International Rapids section of the St. Lawrence River, will develop 2,200,000 horsepower divided equally between Canada and the United States. In the Soulanges section, the output can be increased from 1,000,000 hp. at present to 2,000,000 hp. In the Lachine section 1,200,000 hp. might be generated.

Elimination of the 115-mile bottleneck between Montreal and Prescott would allow vessels carrying 20,000 tons to penetrate into the Great Lakes. At present the largest vessels that can go through the small locks by-passing the rapids carry less than 3,000 tons. Removal of the navigation bottleneck would save many millions of dollars a year in costs of moving grain, coal and other goods that now use the small canals or follow alternative routes to market.

Mr. McLeod estimated that this saving could amount to $30 million a year, even after tolls were paid.

The seaway promises to double the market for Quebec-Labrador iron ore, and to open an even greater future for this development. Labrador ore will become even more important as the Mesabi and other iron ranges near Lake Superior fail to meet the mounting demands.

The combination of power and navigation facilities would stimulate industrial expansion and so permit more of the specialized production needed in modern warfare. The average employment on the project would be 15,000 men assuming a five-year construction program and of these 9,500 would be employed in Canada.

The discussion period which followed more than indicated that Mr. McLeod's remarks stimulated great interest amongst his listeners. Following the discussion period Mr. G. T. Davis commented on the timeliness of the speaker's subject and moved a hearty vote of thanks on behalf of the assembled members.

March Meeting

On March 13, 1952 the Peterborough Branch held a meeting in the Public Library; Mr. S. P. Jones of the Aluminum Company of Canada was the guest speaker and his presentation took the form of coloured motion pictures depicting the preliminary survey work in connection with the Aluminum Company British Columbia Development at Nechako. The speaker was introduced

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by Mr. G. Wade. Before showing the coloured film Mr. Jones gave a brief outline of the history of the Aluminum Company of Canada and described how aluminum has increased in use throughout the world in recent years. Mr. Jones mentioned that one of the chief problems of the Aluminum Company was in locating suitable sites in which relatively inexpensive power could be developed and it was in this search that the Aluminum Company was led to consider the northern regions of British Columbia.

A commentary accompanied the coloured film, and throughout the film it was pointed out that terrain was extremely rugged, so rugged in fact that much of the initial equipment had to be brought in to the site by helicopter. It was pointed out that due to the fact much of this equipment was an extremely light-weight material, called aluminum, the job of transportation was made very much simpler.

The necessity for the building of a dam and the construction of tunnels was described, and the assembled group obtained a much better appreciation of the tremendous problem that is confronting the Aluminum Company of Canada. The discussion that followed brought forth the point that the size of the job that the Aluminum Company is tackling in British Columbia compares very favourably with the size of the job confronting the government in the development of the St. Lawrence River Project.

Mr. H. R. Sills thanked Mr. Jones on behalf of the members of the Institute and guests for the very informative talk and his excellent samples of colour photography.

Saint John

J. A. B. Brennan, Jr.E.I.C.,
Secretary-Treasurer

S. V. Grisdale, M.E.I.C.,
Branch News Editor

January Meeting

A meeting of the Saint John Branch of the Institute was held at the Admiral Beatty Hotel on January 25th.

Dr. A. F. Baird, professor emeritus of the University of New Brunswick, and the New Brunswick delegate on the Federal District Commission, was the principal speaker of the evening.

Dr. Baird talked on the National Capital Plan, and showed some movies which gave the audience a thorough understanding of the plans for the beautification of the national capital.

Dr. Baird gave a brief history of Ottawa, starting from its settlement in the early days of Canada and outlined its progress and growth up to the present time.

A toast to the Association of Professional Engineers of the Province of New Brunswick was replied to by Mr. D. O. Turnbull, newly elected President of the Association. The toast to the Engineering Institute of Canada was replied to by Mr. A. G. Watt.

March Meeting

Mr. Peter Vakamies was the guest speaker at the meeting of the Saint John Branch, March 6, at the St. Andrews Curling Club. Mr. Vakamies is a chemical engineer, employed with the Irving Pulp and Paper Limited, and he delivered a most interesting address on "Finland's Post War Industrial Development".

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Saskatchewan

D. W. Houston, M.E.I.C.,
Secretary-Treasurer

Saskatoon Section

J. A. Wedgewood, M.E.I.C.,
Secretary

Following is a report on night classes sponsored jointly by Adult Education, Department of Extension, University of Saskatchewan; and the Saskatoon Sec-

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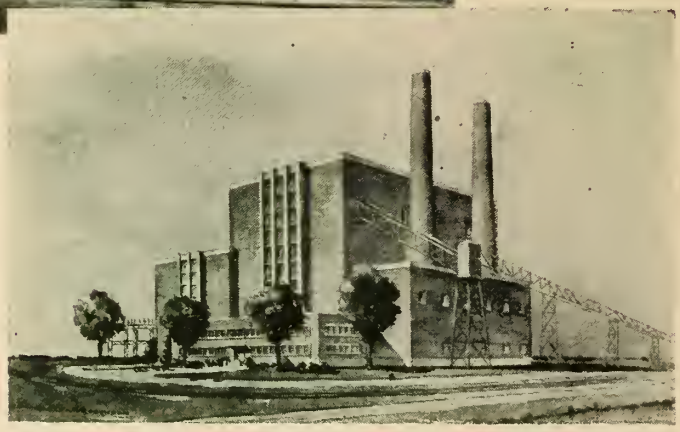

RIGHT: The 400,000 kw (four units) Richard L. Hearn Generating Station of The Hydro-Electric Power Commission of Ontario at Toronto, Canada. Stone & Webster Engineering Corp., Boston, Mass., Engineers and Constructors.

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tion, Engineering Institute of Canada, and the Association of Professional Engineers of Saskatchewan.

In response to suggestions from members, the Section appointed a committee on October 4, 1951, to investigate the possibility of putting on a night class in administrative subjects. This committee consisted of Messrs. D. G. Hoskins, B. M. Ellis, R. Collie, J. A. Wedgewood (Secretary) and, in an advisory capacity, Dean J. H. Thompson and Professor K. W. Gordon of the College of Commerce and Extension Department, respectively. At a regular meeting held on November 7, the committee submitted a draft proposal for organization, financing and conducting a night class. This was approved.

The draft proposed that the section sponsor jointly with the Extension Department a night course in administration which would be fully self-supporting and which would not occasion any expense to the University or to the Saskatoon Section.

Recommendations were made, in this draft, as to admission, scheduling of lectures, and budget, and it was suggested that the extension Department secure the services of suitable lecturers upon the advice of the course committee.

A syllabus of 12 lectures was planned, as follows:

Group I. Three lectures:
1. Value of Cost Accounting.
2. Analysis of Company Financial Statements.
3. Managerial Controls and Techniques.

Group II. Three lectures:
1. Office organization.
2. Plant organization.
3. Contractor's organization.

Group III. Three lectures on labour relations.
1. From the point of view of Management.
2. From the point of view of Labour.
3. The Legal Framework of Labour Relations.

Group IV. One lecture on contracts and agreements.

Group V. Two lectures on cost estimating.
1. In the Contracting Field.
2. In the Production Field.

The Committee advised of its realization that it was not possible to give complete coverage to any of the above topics in the time allotted, but suggested that it would be possible to take such topics as proved to be of particular interest and devote more time to them in future years.

At the time of writing, the course is at the half way point and although a final statement cannot be made, the following experiences to date can be reported:

(a) The registration far exceeded the original estimate, 65 signing up for the course. It is now obvious that the budget expenses will not be exceeded with the result that a surplus of at least $150 will accrue.

(b) Of the speakers selected, only one is a member, only two are from the University (one from the College of Commerce, the other from the College of Law). The majority of the speakers are managers

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of firms in Saskatoon. The major exception to this is the speaker selected for the lecture on labour relations from the point of view of labour who comes from outside the province. Three of the speakers are sitting in on all or part of the lectures themselves.

(c) Six students and four non-engineers have enrolled. The average attendance has been 51.

Sudbury

W. S. Black, M.E.I.C.
Secretary-Treasurer

A. D. Finlayson, Jr.E.I.C.
Branch News Editor

Dinner Meeting

The monthly dinner meeting of the Sudbury Branch was held at the Church of the Epiphany on Thursday Mar. 6, 1952. The meeting was addressed by three members of the branch.

The first speaker, Mr. P. E. Semler, was introduced by Mr. W. B. Ibbotson. Mr. Semler, presently employed in the Mechanical Department of the International Nickel Co. of Can. Ltd., received his engineering degree at Prague University, Czecho-Slovakia. His talk was based on a trip through the Balkan countries with 60 other students while he attended university. The trip was taken before World War II when travel was unrestricted and trips such as this were common at the universities. His talk on the eventful trip brought out many interesting and little known facts and customs of these historic old countries.

The second speaker, Mr. L. T. Lane of the engineering firm of Lane and Lane, Sudbury, Ont., was introduced by Mr. J. E. Quance. Mr. Lane spoke on the Municipal Drainage Act with special attention given to a problem in which his firm has been engaged for the City of Sudbury on improvements to the city's main drainage stream, Junction Creek.

Mr. T. J. Hogg, the third speaker, came from LaCave to address the meeting. He spoke on the hydro development at LaCave on the Ottawa River where he is presently employed by the Hydro Electric Power Commission of Ontario. Mr. Hogg traced the construction of the dam and power plant from its beginning to its present state in which part of the plant is in operation.

The speakers were thanked by Mr. George Fleming.

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Toronto

W. C. Watt, M.E.I.C.,
Secretary-Treasurer

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

March Meeting

"Titanium" was the title of a paper presented to the Toronto Branch on March 6th, 1952, by Dr. O. W. Ellis, director of the Engineering and Metallurgy Division of the Ontario Research Foundation.

A large attendance of members and visitors indicated the interest in such a paper, and several enquiries were made as to where a copy of the paper could be procured.

Dr. Ellis commenced with an enlightening history of the element which dates back 160 years when it was found in magnetic sand in a small village in Cornwall, England. The new element was found by a clergyman by the name of Gregor, and it was named Menachine; the sand from which it was extracted was called menachanite.

Later the metal was discovered by a German who named it titanium, this name being universally accepted. Considerable of the recent work done was with a view to its use for turbine blade application, this however, proved unsuccessful.

A considerable number of slides were shown and a very able explanation made, the various comparisons of strength were of considerable interest.

After the presentation a number of questions were asked which tended to reveal the field to which this material will be best suited.

At the close of the meeting all present adjourned to the Great Hall in Hart House, and a social period took place with coffee and doughnuts being served.

E.I.C.—A.I.E.E. Joint Meeting

A large representation of the Toronto Branch held a joint meeting with an equally large representation of the A.I.E.E. on March 20th, 1952, at the Wallberg Building, University of Toronto. The subject discussed was **The Soniscope.**

A joint paper was presented by J. R. Leslie, and W. E. Parker, both of whom are engaged in the research division of the Hydro Electric Power Commission of Ontario.

The instrument is used extensively for the testing of concrete, particularly in major power developments such as, Des Joachim, Otto Holden Generating Station, and Stewartville. It has been used in Quebec, Nova Scotia, and the United States.

The speakers discussed the design and its application to the ultrasonic testing of concrete, and illustrated several applications showing the work involved in its use. The apparatus is to all intents and purposes portable. It was of interest to note the effort being put forth in this field of research to determine the best methods and procedures to use in order to accomplish the highest standards of quality in concrete construction.

A number of questions were asked by several prominent engineers, which were ably answered by Mr. Leslie and Mr. Parker, and revealed the practicability of the instrument, and its limitations.

The Chairman of the Toronto Branch, W. A. Paterson, introduced the speakers, and Mr. H. R. Osborne, the Chairman of the A.I.E.E. expressed a vote of thanks.

Vancouver

STUART S. LEFEAUX, M.E.I.C.,
Secretary-Treasurer

W. L. INGLIS, M.E.I.C.,
Branch News Editor

Film Program

At a meeting of the Vancouver Branch in the new Engineering Building at the University of British Columbia on March 19, a program of films was presented.

"The Curiosity Shop" described in colour some of the research work being carried out in the aluminum industry.

"United 6534", a technicolor film showed the maintenance, overhaul and operating functions of United Air Lines, as related to one of their mainliner aircraft. This film, recently produced, took the audience through the shops and into the air, on a tour which was not only educational but most enjoyable.

The final film "Exploring with X-Ray", told the story of the discovery of X-rays and their application in industry as well as medicine.

Mr. S. H. de Jong, chairman of the Branch expressed the thanks of the meeting to Mr. Ben Stevenson, United Air Lines representative, for showing the films.

Approximately 75 members and their friends were in attendance.

Student Executive

Executive officers elected by the Student Section at the University of B.C. for 1952-53 are as follows: Chairman, Vern McDonald; Vice-president, Norm. Moysa; Secretary-treasurer, Doug. Third; Recording secretary, George Faulder; Program chairman, Jack Brooks; Publicity and membership chairman, Frank Payne.

Student Night

The annual Student Night of the Vancouver Branch was held on February 27 in the new Engineering Building at the University of British Columbia under the chairmanship of Mr. S. H. de Jong.

About 50 members and students were present, among them Dr. L. Austin Wright, who was visiting Vancouver in connection with arrangements for the forthcoming annual meeting of the Institute.

According to the usual custom of Students Night, papers were presented by three student members who had been selected as the three best in a competition previously held by the Engineering Students among themselves.

The speakers were introduced in turn by Stan. Wilkinson, chairman of the Student Branch.

The first paper on **Neutralizing of Magnetism in Ships** presented by Jack Douglas, 4th year electrical engineering, dealt with methods of degaussing ships to protect them against magnetic mines.

Second speaker was Al. Cronk, a 4th year mechanical student, whose paper on **Piercing rolled and extruded sections** described a method by which aircraft plants carry out the exact punching of structural parts by means of a machine known as a "duplicator" employing an ingenious arrangement of rocker arms, micro switches, and solenoids in conjunction with a standard punch press.

W. G. Robinson, a 4th year civil student, speaking on **Geophones and their use in prospecting** explained how this modern method using the principles of the seismograph has revolutionized

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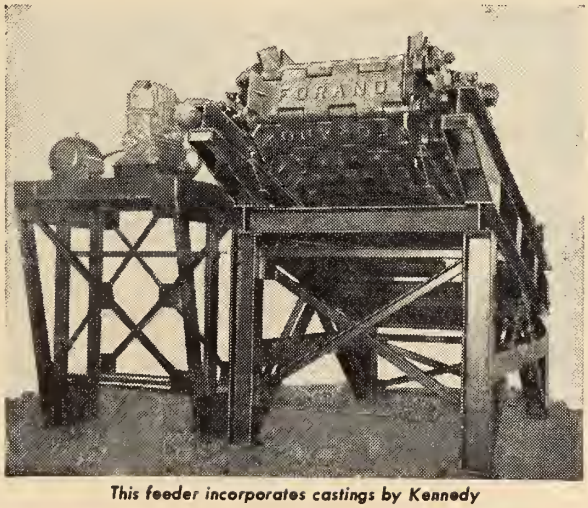

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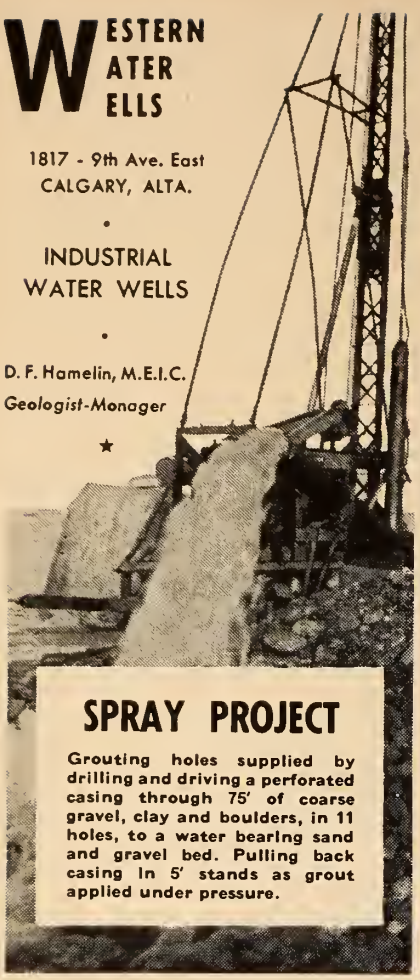


the task of obtaining geological information at varying depths.

The papers were judged by a committee of members comprising Messrs F. M. Cazalet, J. S. Kendrick, and F. C. Leroux. Book prizes were awarded as follows: 1st prize, donated by Canadian Liquid Air Co., went to Al. Cronk; 2nd prize, donated by Western Bridge Co., to Jack Douglas; 3rd prize, donated by Sandwell and Co., to Mr. Robinson. The speakers were congratulated by Professor Archie Peebles.

Dr. Wright in presenting the prizes also congratulated the speakers on their very excellent papers and took the opportunity of mentioning some of the plans that have been made for the Annual Meeting to be held in Vancouver for the first time in the 66 year history of the Engineering Institute.

A.S.C.E.—E.I.C. Meeting At Seattle

On Saturday, March 8, about 30 members of the Vancouver Branch and their ladies travelled to Seattle, Washington, to be the guests of the Seattle section of the American Society of Civil Engineers.

During the afternoon visits were made to various points of interest, cars being provided by the Seattle members for two separate tours.

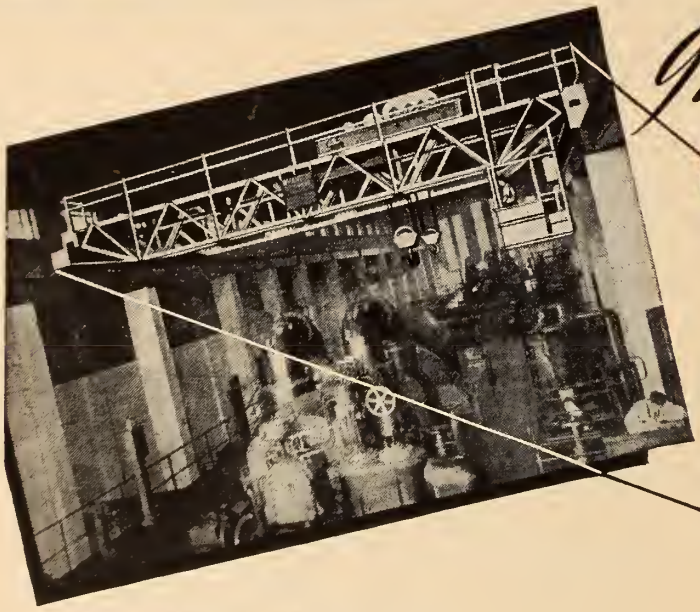
One group proceeded first to the Seattle-Tacoma Airport where a tour of inspection included the modern administration building, sewage treatment plant ,and hangar facilities. The party was also shown through a Boeing Stratocruiser and obtained a general picture of airline operation at this busy West Coast Airport. From the Airport this group next visited the famous floating bridge across Lake Washington. Reputed to be the largest floating structure in the world, the bridge is 6,560 feet long and 60 feet wide comprising 25 pontoon sections of reinforced concrete.

The second group first visited the Northgate Regional Shopping Centre, the largest development of its kind anywhere in the world. This development, located in a suburban section of the City, provides complete shopping facilities with adequate car parking areas adjoining, all excellently planned and executed in a modern style of architecture. From Northgate this group was taken to the University of Washington for an inspection of the civil engineering laboratories.

In the evening a dinner was given at the College Club and was attended by some 160 persons. Mr. C. C. Arnold, president of the Seattle Chapter, American Society of Civil Engineers, gave a short address appropriate to the occasion, mentioning that this was the first joint meeting of the Engineering Institute and the Seattle Chapter of A.S.C.E. The Chairman of the Vancouver Branch, Mr. S. H. de Jong, in thanking the Seattle Chapter for their excellent hospitality, expressed the hope that further meetings of this kind would be held and that the next would be in Vancouver.

Mr. H. T. Libby, Vancouver Branch Program Chairman, speaking briefly on arrangements for the Annual Meeting of the Institute, invited members of

(*Continued on page 474*)



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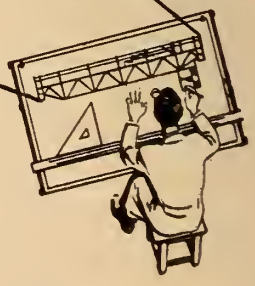

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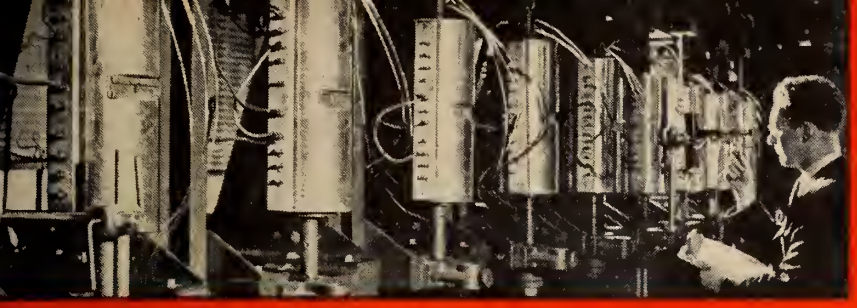

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

The Canadian Who's Who, volume 5, 1949-1951. Toronto, Trans-Canada Press, 1951. 1,159 pp. $24.00.

"The only who's who in Canada in which no biographical sketch can be paid for", to quote the slogan of this publication, is what one should bear in mind when considering this book for their reference shelves.

It contains over four thousand biographies of Canadians at home and abroad, and the main body of the text is arranged alphabetically. A very useful idea in this section for quick reference is the use of block type for the present activity of the biographee.

Preceding the text are nine pages of abbreviations used in this volume, "Deaths reported during the courses of printing", and "Biographies received too late for insertion in their regular place in the book" (also continued at the end of the book).

The Who's Who directory at the end of the volume, is an alphabetical directory by subject to the biographees. This will be a great convenience particularly for people listed in this book to find other names in their same field all listed together.

An additional feature to be noted is an addenda service being instituted by the publishers. This is in the form of a six monthly booklet, and the service costs fifteen dollars. This will include new biographics of important people on the Canadian scene as the biographies are received in the publishing office. This will keep subscribers completely up-to-date to the time of the next issue of The Canadian Who's Who. This is a must for every library, and a most desirable addition to practically all office and home bookshelves.

E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

ABC of Plain Words. Sir Ernest Gowers. London, H.M.S.O.; Ottawa, United Kingdom Information Office, 1951. 146 pp., 75 cents, paper; $1.15 cloth.

As could be judged from its title, this is a supplement to PLAIN WORDS. The latter was written at the invitation of the Treasury to help in improving official English.

The ABC is a reference book with entries under headings alphabetically arranged.

Have you any simple, logical, and more or less fool-proof knowledge of the proper use of the comma?

Do you use the word "global" in its proper current meaning?

What do you do with "got"; or "lack" and "dearth"; or "nor" and "or"; or the much mis-used semi-colon?

If you find yourself slightly confused at this point, you should see this ABC.

Asphalte in Modern Building Construction. G. J. Hancock. London, Newnes, c1950. 230 pp., illus., 30/–.

In this book, detailed information will be found on the nature, composition, manufacture and uses of mastic asphalte, the technique of asphalting, and the testing and analysis of the manufactured material and its components. The chapters devoted to the details of construction in which mastic asphalte is employed, and to the specification and measurement of asphalte work will be found of particular value not only to the asphalte contractor, but to the architect or civil engineer who is concerned with this material in the design and erection of buildings. This publication contains many illustrations, a detailed index, and a list of references to British standards and to British government specifications.

Broadcast Operator's Handbook, 2nd ed. H. E. Ennes. New York, Rider, c1951. 440 pp., illus., $5.40.

The first four parts of this second edition cover the operating practices in the control room, at the master control, outside the studio, and at the transmitter. A fifth and a sixth part consist of the technical data necessary for the maintenance and proper operation of station equipment. Methods of setting up routines for meeting emergencies in the studio control room are discussed in one of the new chapters. Also new to this edition are studio equipment maintenance procedures, and additional material for transmitter maintenance. FM broadcasting is discussed in all of its phases: transmitter equipment, noise level measurements, monitoring, antennas, etc. This book is well illustrated through diagrams, drawings and photographs. It is adequately indexed and contains a short bibliography of a dozen books.

Carburation, 3rd ed. rev. Volume I: Applied Carburation and Petrol Injection. C. H. Fisher. London, Chapman, 1951. 356 pp., illus., $7.25.

This is the first volume of a revised two-volume, third edition. It deals mainly with the theoretical aspects of carburation. The eight chapters into which the book is divided deal with the following subjects: Introduction to carburation, fuels, mixture characteristics, carburettor operation, elementary hydraulics of the carburettor, carburation and the induction system, contemporary induction manifold design and the testing of mixture distribution, aircraft carburation and petrol injection. This last chapter covers almost one hundred pages and discusses the pros and cons of petrol injection versus carburation, points the necessity of injection in aircraft and reviews the injection systems now in production. This book contains many drawings and a few photographs. It is well indexed but contains no bibliographical references.

Fractional Horse Power Motors. S. F. Philpott. London, Chapman, c1951. 367 pp., illus., 30/–.

This book has been written to fill the needs of British manufacturers of small motors and motor driven appliances, the author having endeavoured to make the subject matter as representative as possible of British F.H.P. motor practice. Despite this British point of view, we feel assured that the Canadian or American reader seeking information on small motors will consider this book as a source of useful information. This book is practical: no attempt has been made to go deeper into motor theory than is necessary to understand the working principles. Its purpose

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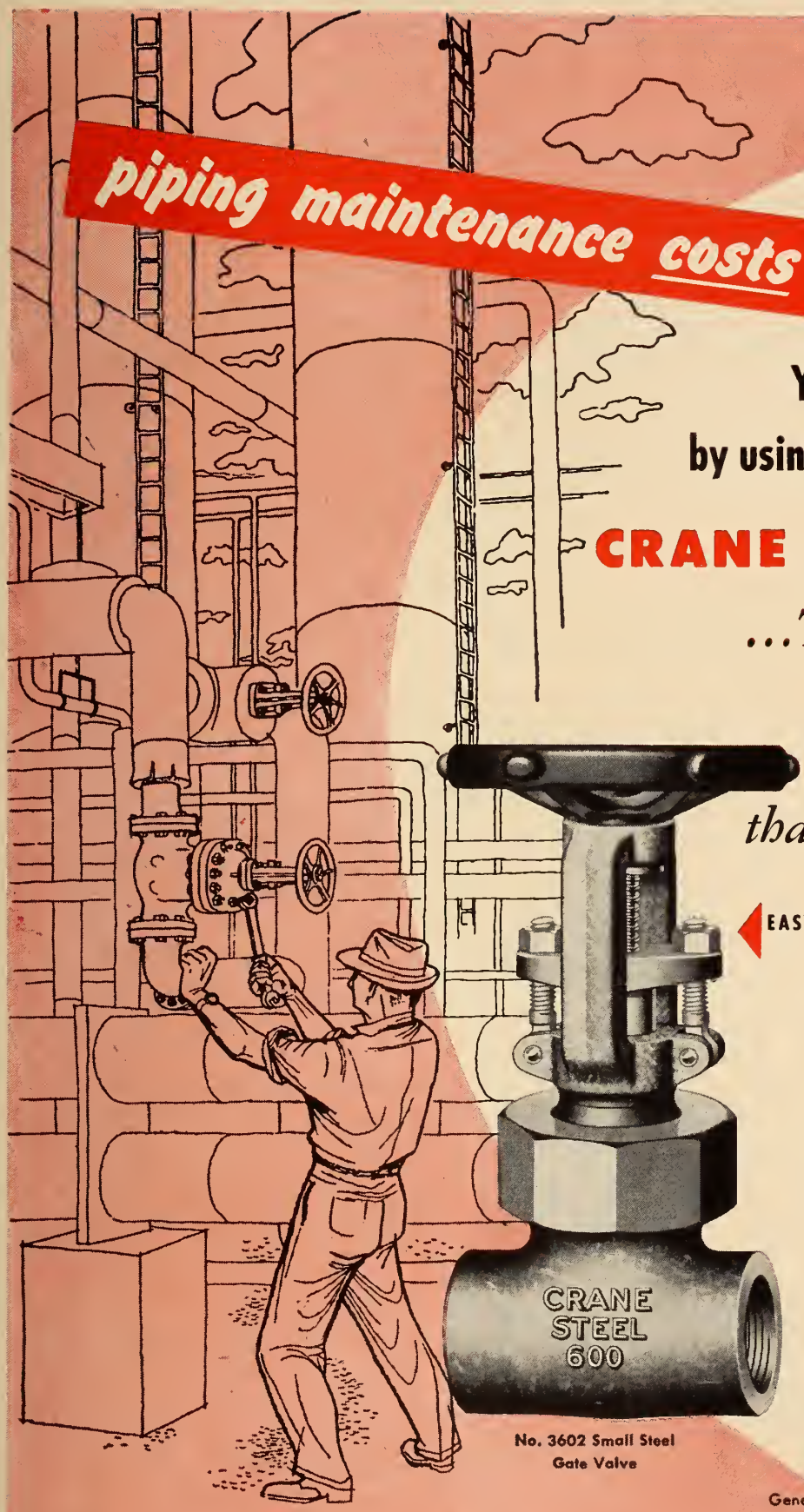

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By LEE H. JOHNSON, *Tulane University.*

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1952 150 pages, 98 illus. $4.69

ELECTRICAL MEASUREMENTS

By FOREST K. HARRIS, *National Bureau of Standards.*

The most thorough study of d-c and low frequency measurements ever published. Each subject is analyzed in detail to impart a working knowledge of methods and apparatus employed in measurements. Precautions, suitability for particular tasks, limitations and expected errors are stressed.

1952 784 pages, 439 illus. $10.00

ANTENNAS: THEORY AND PRACTICE

By SERGEI A. SCHELKUNOFF *and* HARALD T. FRIIS, *Bell Telephone Laboratories.*

Up-to-date survey of antenna behavior, design, phenomena. This thorough compilation covers Physical Principles of Radiation, Maxwell's Equations, Plane and Spherical Waves, Directive Radiation, Directivity and Effective Area, Antenna Current, Impedance, Reciprocity, Equivalence and many other basic subjects.

1952 640 pages, illus. $12.50

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Devoted to recent, important work in advanced antenna theory. Contains a wealth of previously unpublished material and covers such important subjects as Spherical Waves, Mode Theory of Antennas, Spheroidal Antennas, Integral Equations, Natural Oscillations, and others.

1952 216 pages, illus. $8.13

PLASTICS MOLDING

By JOHN DELMONTE, *Furane Plastics, Inc.*

For the fabricator, this volume shows the application of principles vital to successful molding practice. It shows the ordinary flow of materials and the techniques for handling these materials once the flow principles have been properly established. Analyzes equipment, accessories and methods which permit a molder to attain a high degree of versatility

1952 493 pages, illus. $11.25

DATA BOOK FOR CIVIL ENGINEERS Vol. I — DESIGN

By ELWYN E. SEELYE, *Seelye, Stevenson, Value and Knecht.*

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1951 521 pages, illus. $12.50

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Second Edition. Completely new cost data and sample specifications, with sample contract forms, for nearly every type of building and heavy construction. Provides cost figures tied to the *Engineering News-Record* Cost Index which permit obtaining up-to-the-minute costs.

1951 506 pages, illus. $16.25

HELICOPTER ANALYSIS

By ALEXANDER A. NIKOLSKY *Princeton University.*

A basic book on helicopter theory containing many original and previously unpublished research findings by this noted authority. Covers the theory of rotary wing aircraft and shows how it can be used in analysis of basic helicopter problems. Includes many sample calculations.

1951 340 pages, 182 illus. $9.38

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By R. H. KAUFMAN, *General Electric Co.; and* H. J. FINISON, *Armour Research Foundation.*

Based on both paper analysis and comprehensive flight and laboratory tests, this study explains the practices now used, analyzes their worth and shows how individual electrical devices work together to comprise a complex power system. Uses a minimum of mathematical detail.

1952 206 pages, illus. $6.25

EQUIVALENT CIRCUITS OF ELECTRIC MACHINERY

By GABRIEL KRON, *General Electric Co.*

The only book published on equivalent circuits in general and on equivalent circuits of electric machinery in particular. It covers more elementary and more advanced topics on the operation of machinery than any other volume on electric machinery. Virtually the entire contents are original. Circuits explained may be used immediately without understanding their derivation. No mathematics or mathematical analysis is employed.

1951 278 pages, 172 illus. $12.50

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is to describe the principles, operating characteristics, construction, application, use and maintenance of each type. It contains many illustrations, is thoroughly indexed, but does not give any bibliographical references.

French-English Science Dictionary; new second ed. Louis de Vries. Toronto, McGraw, 1951. 596 pp., $8.80.

Sub-titled "for students in agricultural, biological and physical sciences, with a supplement in terms of aeronautics, electronics, radar, radio, television", this dictionary will fill a great need, particularly in Quebec province, and in all Canadian centres where French is spoken, or where modern French technical books are available.

For the up-to-date technical library or student, it is the one-hundred and seventy-five page appendix that will be found particularly valuable, as will also the table of abbreviations.

As it appears to be the only up-to-date volume of its type on the market at the moment, it comes as a most timely publication, with all the new European engineers arriving in this country.

No science library of any type will be fully equipped without it.

Man the Maker. R. J. Forbes. New York, Schuman, Toronto, Nelson 1950. 355 pp., illus., $5.00.

Subtitled "A History of Technology and Engineering", the author states the purpose of this book to be "an attempt to show how certain of our material achievements arose and became part of that complex of culture traits we call civilization".

Commencing with the Stone Age eolithic, and progressing to the twentieth century with its jet planes and television, this is an account of the discoveries of nature's treasures by the homo sapiens, and the development of his mind and of the world about him as these discoveries come to light and are subjected to his imagination, ingenuity and inventiveness.

Forty-one black and white plates are placed through the text, and there are twenty-seven in-text line drawings, covering such a variety of subjects as a ninth century psalter page, Fuller's screw press, a woodcut of mediaeval agriculture, Duryea's horseless buggy, and a model of Saxton's magneto.

Lewis Mumford says, "there is no other book of this nature available in English, or so far as I know, in any other language". When we say this book is fascinating to anyone the least bit interested in the mechanical and cultural development of man, we do not use the term lightly.

Manufacture of Iron and Steel. Volume 2, Steel Production. G. R. Bashforth. London, Chapman, 1951. 461 pp., illus., 45s.

This survey is intended as a suitable textbook for the general student of metallurgy and at the same time as a handy reference book for the busy industrialist. It includes chapters on the Bessemer processes, the open-hearth processes, electric furnaces, ingots, and side-blown converter practice. Later chapters deal with modification of steel-making processes, blister, shear and crucible steel, steel works instruments, the manufacture of types of special steels and steel works for refractory materials. The book is very well illustrated, through drawings and photographs. Lengthy lists of references are given at the end of most chapters.

Physical Aspects of Colour: An Introduction to the Scientific Study of Colour Stimuli and Colour Sensations. P. J. Bouma. Eindhoven, N. V. Philips Gloeilampenfabrieken, 1947. 312 pp., illus., $5.00.

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While this is not a popular book on colour and colour blending, it still only pre-supposes a high school knowledge of mathematics and physics. It can therefore be of value both to a beginner in the study of chromatics, and to a scientist who wishes to enrich his knowledge in this field. The author achieves this by presenting an insight into the origin and perception of colours in a logical and systematic manner, starting from the recognized laws of colour mixing.

The lengthy appendix contains eleven TABLES FOR THE CALCULATION OF COLOURS, LIST OF SYMBOLS and the sections in the text where they are used, and LITERATURE: i.e., bibliographic references. The book is also subject indexed.

Resistance of Piles to Penetration with Tables of Approximate Values based on the Hiley Formula, 2nd ed. R. V. Allin. London, Spon, 1951. 126 pp., illus., 21/–.

The author employs soil mechanics as a fresh approach to the subject of pile driving. The tables of approximate values fill up more than two-thirds of the book. They facilitate the use of Hiley's pile-driving formula and demonstrate the effects on the ultimate resistance to penetration of varying factors, such as: weight, drop, and types of hammer; quality of the pile, whether concrete or timber; batter to which it is driven; type of cushion employed; condition of the head of the pile at the end of the drive. The text consists of a few very short chapters on general considerations, the Hiley formula, the use of the tables, a direct method of finding the resistance, pile driving and soil mechanics. It is illustrated with graph tables and diagrams.

Some Aspects of Fluid Flow: being the Papers presented at a conference organized by the Institute of Physics at Leamington Spa on 25th-28th October, 1950, and the Reports of the Conference Discussion Groups. London, Edward Arnold, Toronto, Longmans, Green, c1951. 292 pp., illus., $10.00.

The fifteen papers presented at this conference are divided in four groups. The first group deals with industrial problems involving the turbulent mixing of fluids, the combined flow of fluids and solids, the pattern of fluid flow, and the hydromechanics of fluid flow. The second group deals with fundamental problems: atomisation of liquids, boundary layers and skin friction in a compressible fluid flowing at high speed, etc. In group three follow papers on techniques for the study of fluid flow, of employing radon for tracing gas flow in hot systems, etc. The last group is concerned with some applications of the present knowledge and of these techniques. This work also contains five short reports from discussion groups. It is well illustrated and indexed, and adequate bibliographical references are given at the end of each paper.

Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1951, 88th Annual Publication. S. H. Steinberg, ed. Toronto, Macmillan, 1951. 1,624 pp., maps, $7.50.

After examining the Statesman's Yearbook, one is struck chiefly by the excellent table of contents at the front, and the comprehensive index at the back, which enable the searcher to find practically anything contained therein by a flick of the finger.

However, this one finds a very necessary adjunct to this particular volume, as the arrangement of places is, at times, confusing.

Also, the informed reader will be considerably surprised to find twelve provinces listed for Canada. Further surprise will be occasioned by the fact that no tobacco is to be found in Canada, in spite of Norfolk County. Tobacco was just a subject picked at random. But with only three pages allotted to Ontario, there is no room for detail.

The book is packed full of useful, valuable information, but what information one will find under which country, one never knows. Constitution and government, population Statistics, and Religion, seem to be common to most of the entries, but beyond that, editorial policy seems to be slightly confused.

The information our readers will find really invaluable is that on international organizations, and the varied masses of statistics and information contained in section four, which is all countries not included in the British Commonwealth or the United States. This information includes Constitution and Government, religion, justice, education, finance, defence, production and industry, money, weights and measures, and a host of other headings which are not readily found in many books of reference.

For this international and foreign information, it will be an excellent addition to the reference shelf.

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Steels in Modern Industry: a comprehensive Survey by 29 Specialist Contributors. W. E. Benbow ed. London, Iliffe, c1951. 562 pp., illus., 42/–.

The present work is divided into four parts. Part one is a general metallurgical introduction written by the editor. Part two contains a series of articles on the properties and characteristics of steels under the major operating conditions of stress, temperature and environment encountered in service, and articles on weldability and machinability. Part three deals with selected and specific user aspects in the fields of structural, mechanical and electrical engineering, many articles being devoted to the last two fields. In part four, attention is given to some of the more important forms of surface treatment. Most articles are illustrated, and each one contains an excellent list of references.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Creep of Metals. L. A. Rotherham. London, Institute of Physics, 1951. 80 pp., illus., $2.25. (Physics in Industry Series.)

Of interest to both metallurgists and engineers, this monograph is concerned with the salient characteristics of the physics of creep phenomena in metals. The subjects dealt with are: the characteristics of the creep curves; crystalline flow; metallographic features of creep; grain boundary, transient, steady-state, and tertiary creep, and the development of creep resistant alloys.

Data Book for Civil Engineers, 2nd ed. E. E. Seelye. New York, Wiley, 1951. Vol. 1, Vol. 2, Specifications and Costs. Illus. Vol. 1: $12.50; Vol. II: $16.25.

Vol. I presents a concentrated collection of effective data necessary for design procedures in the main fields of civil engineering: structures, sanitation, water supply, drainage, roads, airfields, dams, docks, bridges and soils. The object is to provide a single reference volume for the engineer whose work may spread into fields outside his specialty. Modern codes, practices, and designs are emphasized.

Vol. II provides data necessary to prepare specifications for airports, roads, railroads, bridges, dams, docks, drainage and sewers. Swimming pools and athletic fields are briefly considered. Relative cost analyses are included for each type of work, and there is a classified glossary of terms.

The first edition included a third volume on field practice.

Fundamentals of Automatic Control. G. H. Farrington. New York, Wiley, 1951. 285 pp., illus., $6.00.

A general survey of a wide field, dealing with the underlying principles which affect automatic control performance rather than with the specific details of plant or apparatus. A thorough mathematical analysis is provided, and the formulation and use of analogies is considered. The final chapter deals briefly with the selection and adjustment of control systems.

Instrumentation of Open-Hearth Furnaces. British Iron and Steel Research Association. London, George Allen and Unwin, 1951. 159 pp., illus., 30s.

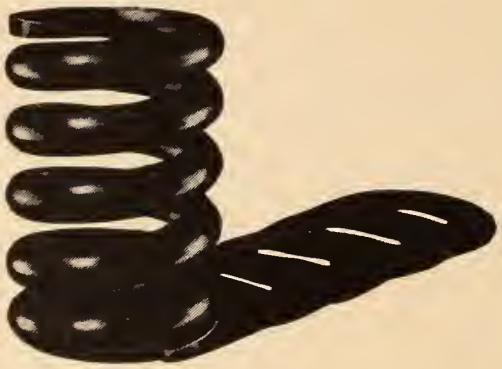
Part I discusses the function and basic principles of instruments, outlines a recommended level of instrumentation, and suggests how instruments can be utilized to determine optimum working conditions and maintain effective and economic operation over a prolonged period of time. Panel layouts and automatic control systems are included. Part II provides brief descriptions of the construction details and operation of the instruments most commonly used in British open-hearth furnaces melting shops.

Manufacturing Processes, 3rd ed. M. L. Begman. New York, Wiley, 1952. 608 pp., illus., $7.20.

Beginning with foundry practice and ending with grinding wheels and abrasives, this volume presents the technical fundamentals of the important manufacturing processes. discusses engineering materials, and describes the modern machine tools necessary for processing these materials. Inspection and gaging are covered. New material includes continuous casting of metals, hydrodynamic forming, plastic molds, special welding technique, new jigs and fixtures and various automatic and semi-automatic production machines.

Principles of Radio, 6th ed. Keith Henney and G. A. Richardson. New York, Wiley, 1952. 655 pp., illus., $6.60.

Many changes have taken place in radio in the seven years since the previous edition. In view of the changes the authors have revised and rewritten much of the text and have changed the problems and illustrations, but the aim of the work remains the same—to present the material so clearly that the book can be used by those who must study radio without the aid of a teacher.



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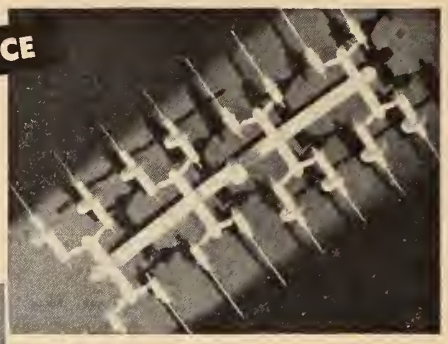

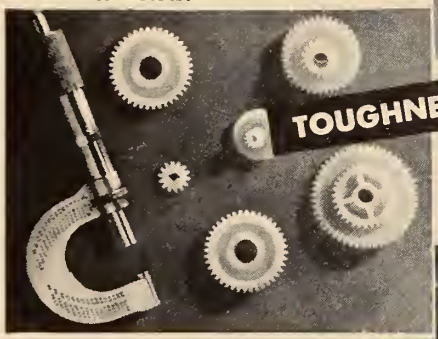

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PLASTICS SECTION
Chemicals Department

STANDARDS

British Standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W. 1. British Standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 467: 1952—Colouring and Marking Wooden Pattern Equipment for Foundries. 2/–. Complementary wall chart. 1/–.

This standard provides one colour scheme for all patterns, irrespective of the metal in which they are to be cast. It gives effect to the majority of current practice and illustrates by means of a diagram and key of a typical pattern and core box, the appropriate colouring of patterns and core boxes for ferrous and non-ferrous castings. The wall chart is an enlargement of this diagram and key.

B.S. 978: 1952, Part 1—Involute, Spur, Helical and Crossed Helical Gears. 2/6.

The present publication applies to machine cut involute, spur, helical and crossed helical gears to 20 to 200 D.P. for instrument and clockwork mechanisms. It provides for two classes of gears: Class "A" for high accuracy and Class "B" for all other applications. Provisions are included relating to the modification to the addendum of pinions with sixteen teeth and less, and the extension of centre distance in spur gear pairs in which the sum of the number of teeth is thirty-three and less.

B. S. 978: 1952—Gears for Instruments and Clockwork Mechanisms. Part 2—Cycloidal Type Gears. 3/6.

This standard differs substantially from the original B.S. 978, 1941, as a cycloidal type of gear has been substituted for the circular arc form. The standards of the Swiss and Black Forest watch and clock industries, have been used as a basis. An explanation of this type of gearing, as applied to wheels driving pinions, is included in Appendix A.

B.S. 978: 1952—Gears for Instruments and Clockwork Mechanisms. Part 3—Bevel Gears. 3/6.

This standard is complementary to the 1951 edition. It covers machine cut conical gears connecting intersecting shafts and having pitches from 20 to 80 D.P. The teeth have a normal pressure of 20 degrees at the pitch cone and they may be either straight or curved. It provides for the form of gear tooth and lays down the permissible errors and tolerances for the two classes of gears ("high accuracy" and "other applications").

B.S. 1332: 1952—Guide to Civil Land Aerodrome Lighting. 3/–.

This guide gives information on beacons, approach, threshold, runway, taxiway, obstruction and boundary lights and in addition it deals with flood lights, traction indicators, ground traffic signalling lights and portable and emergency lighting. A diagrammatical arrangement of lights on an aerodrome is included, together with appropriate graphical symbols.

B.S. 1728: 1952—Methods for the Analysis of Aluminium and Aluminium Alloys. Part 2—Magnesium. (Mercury Cathode Method). 2/–.

In this standard, the re-agents required, recommended methods of sampling and test procedures are specified. The method provides (a) for alloys having a silicon content less than 2 per cent, and (b) for

alloys having a silicon content greater than 2 per cent. This method is applicable to alloys having magnesium contents between 0.02 and 15 per cent.

B.S. 1728: 1952—Methods for the Analysis of Aluminium and Aluminium Alloys. Part 3—Zinc (Mercury Potassium Thiocyanate Method). 2/–.

In this part 3, the same method as in part 2 is employed. It is applicable to alloys having zinc contents between 0.2 and 6 per cent.

B.S. 1806: 1952—Dimensions of Toroidal Sealing Rings. 2/6.

This applies to the dimensions of toroidal sealing rings, sometimes referred to as "O" seals, which are used as packings for reciprocating mechanisms and as gaskets for static purposes for light and medium general engineering applications. These sealing rings are not intended for use at pressures in excess of 1,500 lb./sq. in. 73 sizes are specified.

B.S. 1807: 1952—Gears for Turbines and Similar Drives. Part 1—Accuracy. 3/6.

This standard includes three classes of gears, of which Class A1 and class A2 are generally appropriate for pitch line speeds in excess of 10,000 ft. per min. or where any other factor demands the highest grade. The standards of accuracy laid down for Class B would generally be appropriate for lower pitch line speeds. The section relating to wheels and pinions deals comprehensively with the permissible errors for undulations, transverse pitch, axial pitch, tooth thickness and backlash.

B.S. 1814: 1952—Marking System for Grinding Wheels. 2/–.

The sequence in which the symbols are used gives a general indication of the hardness and grit sizes of any one wheel as compared with another. It will be appreciated that the widely differing conditions under which grinding wheels are used make it impracticable to state that wheels of similar markings made by different manufacturers will necessarily give the same grinding action.

TECHNICAL BULLETINS RECEIVED

American Society for Testing Materials. Special Technical Publications:

No. 60-A—Paper and Paperboard: Characteristics, Nomenclature and Significance of Tests. No. 119—Symposium on Thermal Insulating Materials.

Standard on Engine Antifreezes:

American Water Works Association. Tentative Standard Specifications:

No. C302-51T—Reinforced Concrete Water Pipe—noncylinder type, not prestressed.

Bell Telephone System. Monographs:

No. 1877—The calculation of travelling-wave-tube gain, by C. C. Cutler. No. 1878—Seven-league oscillator, by F. B. Anderson. No. 1879—Thermal variation of Young's modulus in some Fe-Ni-Mo alloys, by M. E. Fine and W. C. Ellis. No. 1880—A broad-band transcontinental radio relay system, by T. J. Grieser and A. C. Paterson. No. 1881—Transient currents in the pulsed Townsend discharge, by J. A. Hornbeck. No. 1882—Experimental radiotelephone service for train passengers, by Newton Monk. No. 1883—A servo system for heterodyne oscillators, by T. Slonczewski. No. 1884—Domain patterns on nickel, by H. J. Williams and J. G. Walker. No. 1885—Filamentary growths on metal surfaces, "whiskers", by K. G. Compton and Others. No. 1886—A spatial harmonic amplifier for 6mm wavelength, by S. Millman. No. 1887—Analysis of audio-frequency atmospherics, by R. K. Potter. No. 1888—Remarks concerning wave propagation in stratified media, by S. A. Schelkunoff. No. 1889—Field equivalence theorems, by S. A. Schelkunoff. No. 1890—On electromagnetic waves reflected from rough surfaces, by S. O. Rice. No. 1891—Laminated conductors for reducing skin-effect losses, by A. M. Clogston. No. 1892—N-terminal switching circuits, by E. N. Gilbert. No. 1893—Coaxial impedance standards, by R. A. Kempf. No. 1894—Sound wave and microwave space patterns, by W. E. Kock and F. K. Harvey. No. 1895—Instantaneous companders, by C. O. Mallinckrodt. No. 1896—Travelling-wave amplification on coupled lines, by W. E. Mathews. No. 1897—Measurements in multipaired cables, by J. T. Maupin. No. 1898—Pulsed Townsend discharges on a millisecond time scale, by J. P. Molnar. No. 1899—Magneto-resistance effect in oriented single crystals of Ge, by G. L. Pearson and H. Suhl. No. 1900—Waves in electron streams and circuits, by J. R. Pierce.

British Electrical and Allied Research Association. Technical Reports:

No. G/T259—Intrinsic safety of electrical circuits in relation to the explosion hazard in industry and relative ease of ignition by weak sparks of various gases and vapours, by J. A. B. Horsley. No. G/XT131—Gas-blast circuit-breakers: a preliminary study of arc form and movement in a single axial blast experimental model, by F. O. Mason. No. G/XT137—

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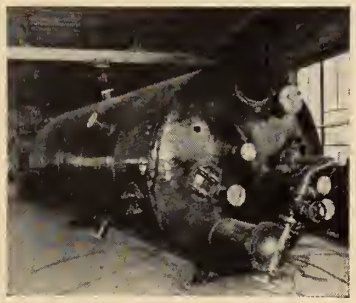

Platework

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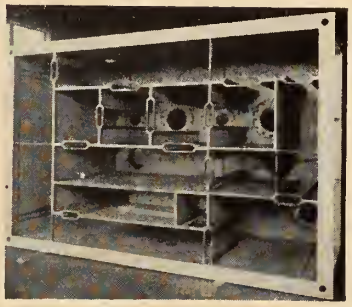

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Series breaks in circuit-breakers: some factors affecting accuracy in recording the distribution of restriking voltage, by F. O. Mason. No. L T248—The Zeeman effect in astrophysical spectra, 3: Bright-line stellar spectra, by C. E. R. Bruce. No. L T250—The static and dynamic rheological properties of dielectrics, by W. Lethersich. No. L T264—Some aspects of the relation between the relaxation spectrum and the creep spectrum. A new mathematical relation concerning the Delta function, by B. Gross and H. Pelzer.

Canada, Department of Resources and Development, Water Resources Division. Water Resources Papers:

No. 101—Arctic and Western Hudson Bay Drainage and Mississippi Drainage in Canada in British Columbia, Alberta, Saskatchewan, Manitoba, the Northwest territories and Western Ontario, Climatic Years 1945-46 and 1946-47. No. 108—Atlantic Drainage: New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland, Climatic Years 1948-49 and 1949-50.

Edison Electric Institute. Specifications:

No. TD-23—Guy clamps.

Edison Electric Institute and National Electric Manufacturers Association. Standards:

EEI Pub. No. TDJ-110 and NEMA Pub. No. 108—Distribution Fuse Links.

Institution of Structural Engineers. Civil Engineering Codes of Practice:

No. 2—Earth Retaining Structures.

Iowa Engineering Experiment Station. Bulletin:

No. 171—Secondary Buckling in Hollow Rectangular Column Sections of Steel Plates, by Frank Kerekes and W. H. Nedderman.

Ohio State University, Engineering Experiment Station. Bulletin:

No. 146—Differential Thermal Analysis of Clay Minerals under Controlled Thermodynamic Conditions, by R. L. Stone.

United States, National Bureau of Standards. Building Materials and Structures Report:

No. 124—Fire Tests of Steel Columns protected with Siliceous Aggregate Concrete, by N. D. Mitchell.

...Circular:

Reference Tables for Thermocouples, by Henry Shenker and Others.

...Miscellaneous Publications:

No. 197—Fire Tests of Bulb-Type Carbon-Tetrachloride Fire Extinguishers, by O. H. Hodge.

United States, Highway Research Board. Bibliographies:

No. 11—Origin-Destination Surveys and Traffic Volume Studies, by R. E. Barkley. No. 12—Joint, Crack, and Undersealing Materials, Annotated by C. W. Lovell.

BOOKS RECEIVED

After the Whistle Blows: a Guide to the Field of Recreation in Industry. Jack Petrill. New York, Industrial Recreation Bureau, c1949. 351 pp., illus., $10.00.

Building Research Congress, 1951. 3 Volumes. London, Building Research Congress, 1951. Illus., 50/–.

Canadian Railway Guide with Airlines. Montreal, International Railway Publishing Co., 1952. Maps, $4.00.

Consulting Engineers Who's Who and Year Book, 1952. London, Princes Press, 1952. 310 pp., 7/6.

D-C Power Systems for Aircraft. R. H. Kaufmann and H. J. Finison. New York, Wiley, 1952. 206 pp., illus., $6.00.

Displacement Method of Frame Analysis. G. P. Manning. London, Concrete Publications, 1952. 120 pp., illus., 9/–.

Elements D'optique Electronique. Gaston Dupouy. Paris, Armand Colin, 1952. 218 pp., illus., 260 fr.

Engineers' Illustrated Thesaurus. Herbert Herkimer. New York, Chemical Pub. Co., 1952. 572 pp., illus., $7.20.

Exercices de Radioélectricité: Lignes, Antennes, Hyperfréquences. S. Albagli. Paris, Gauthiers-Villars, 1952. 76 pp., illus., 550 fr.

M.M. Year Book, 1952: a Comprehensive Guide to Sources of Supply of New and Second-Hand Machinery of British and Foreign Origin. London, Machinery Market Ltd., 1952. 724 pp., 15/–.

Metropolitan Water District of Southern California: Report for the Fiscal Year July 1, 1950 to June 30, 1951. Julian Hinds. Los Angeles, the District, 1951. 110 pp., illus.

National Reference Book on Canadian Personalities with other General Information for Library, Newspaper, Educational and Individual Use, 9th ed. Montreal, Canadian Newspaper Services, 1951. 857 pp., illus.

National University of Ireland: Calendar for the Year 1951. Dublin, Alex. Thom & Co., 1951. 950 pp.

Nomography and Empirical Equations. L. H. Johnson. New York, Wiley, c1952. 150 pp., illus., $3.75.

Notes on Industrial Engineering. Joseph Krol. Winnipeg, University of Manitoba. 170 pp.

Pipe Resistance for Hydraulic, Lubricating and Fuel Oils, and other Non-Aqueous Liquids. T. E. Beacham. London, Spon, 1951. 61 pp., 18/–.

Plane Table Mapping. J. W. Low. New York, Harper, c1952. 365 pp., illus., $5.50.

Plastics Molding. John Delmonte. New York, Wiley, c1952. 493 pp., illus., $10.80.

Plumbing Fixtures in Vitreous China Porcelain Enameled Cast Iron and Porcelain-on-Steel: a Consolidated Catalogue. Montreal, James Robertson, 1951. Illus.

Practical Photogrammetry. H. O. Sharp, Toronto, Macmillan, c1951. 229 pp., illus., $3.75.

Principle of Relativity: a Collection of Original Memoirs on the Special and General Theory of Relativity. H. A. Lorentz, A. Einstein, H. Minkowski and H. Weyl. New York, Dover, 1923. 216 pp., $1.50, paper; $3.50, cloth.

Production Control. P. D. Donnell. New York, Prentice-Hall, 1952. 304 pp., $5.70.

Radio and Television Receiver Troubleshooting and Repair. A. A. Ghirardi and J. R. Johnson. Toronto, Rinehart, c1952. 822 pp., illus., $7.20.

Refrigeration Principles and Practice. Ezer Griffiths ed. London, Newnes, Toronto, British Book Service, c1951. 579 pp., illus., $8.50.

Reviews of Petroleum Technology, Volume II (covering 1949). George Sell and others ed. London, Institute of Petroleum, 1951. 280 pp., 27/6.

Rigid Frame Formulas: Explicit Formulas of all Statistical Quantities for those Single-Panel Frames which occur in Practical Steel, Reinforced Concrete and Timber Construction. A. Kleinlogel. New York, Frederick Ungar, c1952. 460 pp., illus., $12.50.

Smithsonian Institution: Annual Report of the Board of Regents, showing the Operations, Expenditures and Condition of the Institution for the year ended June 30,1950, Smithsonian Institution. Washington, Govt. Printing office, 1951. 522 pp., illus., $3.60.

Soil Engineering. M. G. Spangler. Scranton, International Textbook (Laurel), 1951. 458 pp., illus., $8.00.

Tacheometry: a Practical Treatise for Students and Surveyors. F. A. Redmond. London, Technical Press, 1951. 248 pp., illus., 21/–.

Thermodynamics of Alloys. John Lumsden. London, Institute of Metals, 1952. 384 pp., illus., $5.50. (Institute of Metals Monograph and Report Series No. 11.)

Tractors and their Power Units. E. L. Barger and Others. New York, Wiley, 1952. 496 pp., illus., $7.80.

Who's Who in Australia, 14th ed., 1950: an Australian Biographical Dictionary of Titled Persons, with which is incorporated "John's Notable Australians". J. A. Alexander, comp. and ed. Melbourne, Colorgravure Publications, 1950. 816 pp., 52/–.

PAMPHLETS RECEIVED

Cement and Concrete Reference book, 1951. Portland Cement Assocaition, Chicago, c1951.

Conditions and Practices in the Canadian Coal Mining Industry. A. Ignatieff and Others. Ottawa, Dominion Coal Board, 1951. (Canadian Mining Journal, Aug., Sept., and Oct., 1951, reprint.)

Corrosion Testing. F. L. LaQue. American Society for Testing Materials, Philadelphia, 1951. (Edgar Marburg Lecture.)

Institute of Oceanography. Vancouver, University of British Columbia, 1951.

List of Inspected Appliances, Equipment and Materials. Toronto, Dominion Board of Insurance Underwriters, 1951.

Loans for Homes. Ottawa, Central Mortgage and Housing Corporation, 1951.

Manual of Information on Artificial Ice Rinks. Toronto, C. A. Meadows & Associates, 1951.

Prêts pour la Construction de Maisons. Ottawa, Société Centrale d'Hypothèques et de Logement, 1951.

Proposed Open-Ditch and Tunnel Sea-Level Ship Canal across Honduras. W. H. Hobbs. Ann Arbor, W. H. Hobbs, c1952.

BUSINESS & INDUSTRIAL BRIEFS

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The Editor

New Equipment and Developments

Pipe Line Operating.—Sarnia products pipe line, which will eventually link Imperial Oil's Sarnia refinery with London, Hamilton and Toronto, began operation on March 15th, with the dispatch of gasoline through the line to London.

The 65-mile stretch from London to Sarnia has been under construction since October, 1951. The remaining 123 miles to Hamilton and Toronto will be built during the summer and the completed line is expected to be in operation next fall.

The 188-mile product carrier is the first major products pipe line to be built in Canada and is expected to cost $10 millions. The Sarnia to London section cost $4¼ millions.

Initially the line will carry two grades of gasoline to London, but when full storage capacity of 215,000 barrels becomes available, five major products —regular and premium gasolines, diesel oil, stove oil and furnace fuels—will be carried.

Deliveries to London will begin at a rate of about 10,000 barrels a day. When the line is completed to Toronto its capacity will be 39,000 barrels a day, with an initial throughput of 22,000 barrels a day.

•

Importance of Electricity.—Speaking in Hamilton recently Herbert H. Rogge, president of Canadian Westinghouse Company said, "Although its employed men and women number only 5,200,000, Canada is one of the world's great industrial nations because electric power supplies productive energy equal that of 100 million people working night and day."

"Water power, when used to produce electricity, has a profound influence on the Canadian economy and consequently on the personal welfare of all of us. For instance, until low-cost sources of power were developed, income and employment came mainly from agriculture. Today, after only 40 years of electric power development, agriculture accounts for 17 per cent of the net value of production while manufacturing is responsible for 50 per cent".

Mr. Rogge said that the utility companies spent $664 million for new facilities in 1949-50 and last year made 881,000 additional horsepower available to consumers. In 1952-53 they will produce another 1,700,000 horsepower and an equal amount in 1954-55.

Commenting on firms engaged in the manufacture of electrical equipment and supplies, Mr. Rogge stated that they had almost doubled in number since 1940. They employed 60,000 people in 1950 as compared with 25,000 in 1940. In the same period salaries and wages rose from $33 million to $155 million. Mr. Rogge said that 30 per cent of the output of the industry consists of consumer products. Major products, such as refrigerators, ranges, washing machines, radio and television are retailed through some 6,500 outlets. Other outlets, by the thousand, handle smaller appliances, lamps and fixtures. "All told," the speaker stated, "employment is provided for about 40,000 people. He said, also, "The electrical manufacturing industry's purchase of materials amounted to $162 million in 1947 but had grown to $300 million by 1951."

•

Canadian International Trade Fair.—The 1952 Canadian International Trade Fair will contain a display of Canada's industrial might that will probably surpass in size and scope any show held previously in this Country. Canadian space bookings in the section devoted to machinery and plant equipment is more than double last year's total of 14,000 square feet.

Eight other countries have also reserved space to show a representative selection of world-wide industrial production. The total space taken so far by machinery exhibits is 64,000 square feet and additional bookings are expected to bring the final figure well ahead of the 70,000 square feet used last year.

•

Montreal Building Code.—The building code advisory committee of the City of Montreal has adopted Approval Bulletin No. 10 which stipulates that, "for Hi-Bond Deformed Reinforced Bars, the allowable unit bond stresses indicated for Deformed Bars in Table 305a of the American Concrete Institute Building Code Requirements for Reinforced Concrete (A.C.I. 318-51) may be used".

The application for approval of Hi-Bond Reinforcing Bars was made by The Steel Company of Canada Limited. On May 31, 1951 Stelco obtained similar approval from the Commissioner of Buildings of the City of Toronto. With this new change in the Montreal building code the two largest Canadian cities have accepted Hi-Bond at the full A.C.I. Code values, eliminating hooks and reducing the length of splices.

•

Canada-U.S. Roads. — Speaking at a meeting of the board of governors of the International Road Federation in Chicago and to the Association of Highway Officials of North Atlantic States, recently, C. W. Gilchrist, managing director of the Canadian Good Roads Association said "An understanding of Canada is essential to the U.S. and the harmonious partnership of the two North American countries. They will be the decisive factor in maintaining freedom in the world.

Mr. Gilchrist stated that a new network of roads is needed to tap the riches of Canada. Roads are the most economical and most efficient means of opening the new areas of the country. He cited the 385-mile long Mackenzie Highway from Great Slave Lake to the Peace River district as the kind of road that would create new commerce and open up for settlement hitherto inaccessible land. "But Canadian roads are inadequate for the job", he stated. "Nothing gives us any assurance that Canadian roads are remotely adequate for their present task or what they might be called upon to do in the future. Highway transportation is a mobile, efficient and low-cost method of servicing remote areas. We must, therefore, look to the highway to develop the frontiers of the continent".

•

Sewage Treatment.—The Paterson Engineering Co. Ltd., Windsor House, Kingsway, London, England, have devised an interesting method incorporating the use of chlorine gas in the treatment of sewage and trade effluents.

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Thermal Power Plants

SURVEYS • REPORTS • DESIGN • CONSTRUCTION • FINANCING

The Company will be pleased to send further information on receipt of requests.

•

Millwork Preservation.—A unit to treat sash, frames and other millwork with pentachlorophenol preservative and water repellent, said to be faster, cleaner and more efficient than presently used open-tank immersion methods, was announced recently by the Wood-Treating Chemicals Company of St. Louis and Carr, Adams and Collier Company of Dubuque, Iowa.

The new process employed by this vacuum sealer unit assures better penetration and distribution of the treating solution in the wood. A final vacuum after-treatment leaves wood surfaces in a dry condition as they come from the unit. Wood treated by this process with solutions of pentachlorophenol will, it is claimed, have high resistance to fungi and wood-destroying insects, as well as a high degree of dimensional stability.

The vacuum sealer unit is available in several sizes and consists essentially of a two-section vertical treating vessel, millwork cage and the auxiliary units and controls for the automatic operation of the system. Complete information may be obtained from Monsanto (Canada) Limited, 425 St. Patrick Street, Montreal.

•

THE TRAVELLING SCREENS
for
CIRCULATING WATER
at
J. CLARK KEITH
Generating Station, Windsor, Ont.
were manufactured by
F. W. BRACKETT & CO. LTD.
Colchester, England

•

"Brackett" Screens can be supplied to suit many varied conditions, and over 800 "Brackett" Screening Installations are giving satisfactory, day and night service all over the world.

•

Full particulars of these SUPER-EFFICIENT SCREENS may be obtained from

Sole Representatives for Canada

THE GENERAL SUPPLY COMPANY OF CANADA
Limited

P.O. Box 238 OTTAWA, ONT. *Phone: 8-8550*

Steam Cleaning.—Clayton Manufacturing Company, El Monte, California, has started manufacturing facilities for a steam cleaning compound, at 1130 Bay Street, Toronto. The compounds manufactured in Canada will be identical in every respect to those formerly shipped from the U.S.

•

Patent Manufacturing Rights Available.—A Canadian patent granted in December, 1951, to the National Research Council covers an electrical resistance thermometer for indicating temperature variations in fluid flowing in a pipe. The patent is available for licensing by Canadian Patents and Development Limited, National Research Building, Sussex Street, Ottawa.

The thermometer was developed by S. G. Bauer, formerly of the National Research Council staff, who has now returned to England. It is a simple device consisting of an electrical resistance suitable for insertion in a pipeline. An important feature is its rapid response to temperature changes. For complete details communicate with: Canadian Patent and Development Limited, at the address given above.

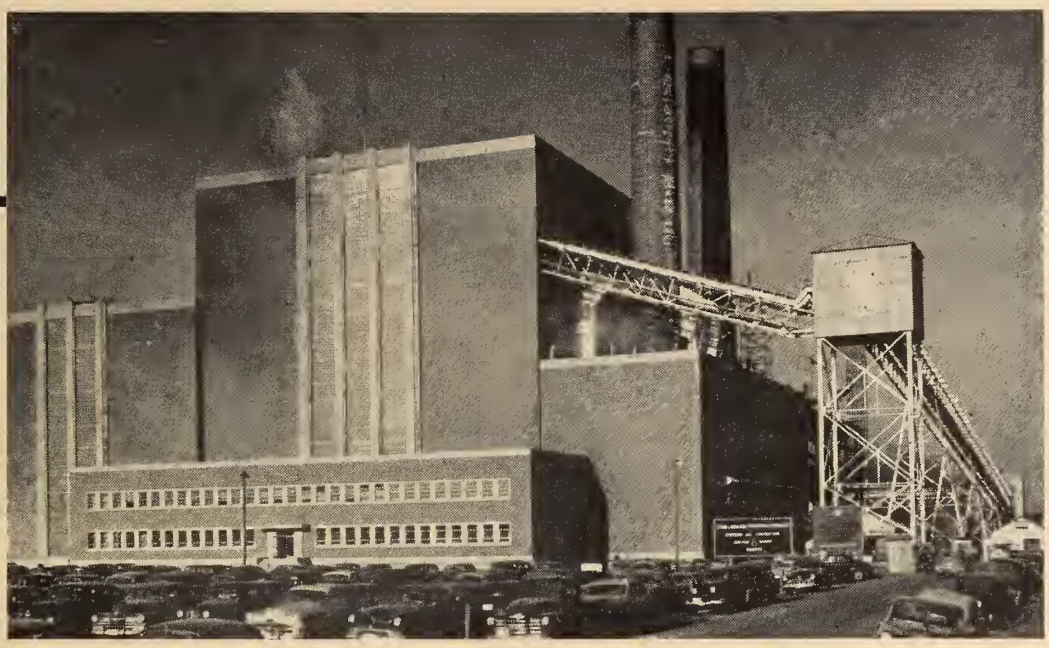
•

Quebec Power Expansion. — "Quebec Power Company is planning new installations costing about $10,000,000 during the next five years, to provide the additional electric power which will be required by new industries in the area, though, like other electric utilities, it faces a problem of low rates and high taxes." J. A. Fuller, president of the Company said at the Company's annual meeting on March 19th.

"It appears certain," Mr. Fuller said, "that this province of Quebec is actually just on the threshold of its eventual industrial greatness. More industries are coming into our province each month. They are attracted by our natural resources, by the splendid labour-force here, and by the markets which our people provide. But, let us not forget, they are also attracted by the very low cost of power in this province—a lower average price, per kilowatt-hour, than is received by electric utilities in any other province or state in North America."

•

Northern Electric Expansion. — Work has been started on a 280,000 square



Richard L. Hearn, Toronto, Ontario

Boilers at Ontario's New Hydro Steam-Electric Generating Stations

equipped with Ljungstrom Air Preheaters

J. Clark Keith, Windsor, Ontario

Both the Richard L. Hearn and J. Clark Keith Steam-Electric Generating Stations are equipped with Ljungstrom Air Preheaters.

Air Preheaters for these two stations are supplied by The Superheater Company, Limited, Montreal, Canadian representative of The Air Preheater Corporation.

Since the war, Ljungstrom Air Preheaters have been specified for boilers furnishing a total of more than 285,000,000 lb. of steam per hour.

THE SUPERHEATER COMPANY, LIMITED
540 Dominion Square Building
Montreal, P.Q.

Canadian Representative for:
The Air Preheater Corporation
60 East 42nd Street
New York 17, N.Y.

CLAYDON COMPANY LIMITED

GENERAL CONTRACTORS

Established 1904

WINNIPEG, MANITOBA

FORT WILLIAM, ONTARIO

PORT ARTHUR, ONTARIO

ATIKOKAN, ONTARIO

foot extension to the wire and cable manufacturing plant at Northern Electric Company Limited at Lachine. It will increase by 75 per cent the plant's manufacturing floor space of 370,000 square feet. The new extension is scheduled for completion early in 1953, the first portion is expected to be ready for occupancy by August 31 of this year.

•

New Instrument Pens.—New industrial instrument pens that eliminate flooding and reduce paper plugging and choking have been designed by Minneapolis-Honeywell Regulator Company, Limited for their strip chart electronic instruments.

The new pens have removable tips and a new reservoir construction which eliminates flooding because the effective ink level is always below the writing tip. Other advantages claimed are—the pen operates with decreased pressure on the instrument chart, thorough cleaning is made easy by a simple disassembly, the new design fits on standard pen carriages thereby permitting improved performance for already installed instruments. For complete details communicate with the Company at Leaside, Toronto, Ontario.

•

R. E. STEWART CONSTRUCTION CORPORATION

GENERAL CONTRACTORS

266 Wellington South Sherbrooke, Que.

Union Carbide Moving. — To obtain larger accommodation for expanding operation and avoid downtown congestion, four of Union Carbide's Canadian units are moving into modern offices in the new building of the Deer Park Branch of the Toronto Public Library at 40 St. Clair Avenue East. The General Offices of Dominion Oxygen Company, Limited will be transferred from the present quarters at Bay and Front to a new location with 35 per cent more space for present and future expansion. Executive offices including accounting, credit, cylinder control, and publicity departments will occupy the new offices. The Ontario district sales office, purchasing department, apparatus warehouse, and repair and apparatus factory offices will remain in their present quarters in the Terminal Building at 207 Queen's Quay West, Toronto. Carbide and Carbon Chemicals Limited will also move all its Toronto offices from 159 Bay St., to the new building. The entire general office organization of Canadian Railroad Service Company, Limited, with headquarters now at 350 Bay St., will move to the St. Clair Avenue building.

Bakelite Company (Canada), Limited, will open a Toronto Sales Office in the St. Clair Avenue premises.

•

Shawinigan Expansion. — To satisfy ever-growing demands for power, The Shawinigan Water and Power Company has made capital expenditures in the past six years equal to 60 per cent of its plant investment at the end of the previous 48 years. This statement was made by J. A. Fuller, president of the Shawinigan Water & Power Company at the Company's annual meeting of March 27. Mr. Fuller also stated that present rates of taxation are making it uneconomical to undertake additional construction.

Commenting on this situation Mr. Fuller said "the Company's taxes and other payments to governments last year amounted to $3.33 per common share, in contrast to earnings of 96 cents a share from power operations, and amounted to more than 20 per cent of power revenues. Federal income tax alone increased 59.6 per cent over 1950, due partly to a greater taxable income but chiefly to the increase of 31.5 per cent in the rate of tax.

"Constantly - expanding industry in Quebec and in all Canada will require more and more power, and electric utilities are ready to expand their facilities to provide it," Mr. Fuller said. "But to obtain the money required" he added, "earnings must be adequate to attract new capital. This remains the major problem of this Company and of the whole electric utility industry. It is a problem to which government must give immediate consideration if utilities are not to be hindered from providing essential services."

"Individuals, property-owners and all industries which provide goods or services should bear a fair share of the tax burden," Mr. Fuller said, and he added, "We accept the obligation of paying our fair share, but because of certain characteristics of the electric utility industry, we are now required to pay much more than our fair share".

•

(*Continued on page 456*)

Power Travels

GENERAL ELECTRIC CABLES

For Distribution

The difficulties presented by terrain . . . the effects of weather, sunlight, and temperature extremes . . . the problems of corona, internal heat, and aging—all these must be considered in the construction of efficient cables for intermediate power distribution.

That's why so many engineers specify "G-E" when planning new lines or replacing old ones. They know that G-E cables are experience-designed and rigorously tested for long-term, economical operation.

Here are some of the particular cables resulting from Canadian General Electric's keen understanding of utility company requirements:

G-E pre-assembled aerial cable

G-E solid-type paper-insulated cable

G-E varnished-cambric-leaded cable

G-E Coronol-Geoprene power cable

For Utilization

Constant awareness of the needs of industry and electrical contractors has resulted in a complete line of General Electric wire and cable for utilization purposes.

Canadian General Electric's success in this field has been, in large part, due to the wide variety of insulations it has developed—insulations specifically engineered to solve particular installation, operation, and maintenance problems. Design engineers, plant maintenance personnel, and electrical contractors know they can rely on these G-E wires and cables for dependable service.

G-E Versatol-Geoprene cable

G-E Deltabeston AVA power cable

G-E varnished-cambric-insulated cable

G-E Interlocked Armor cable, with varnished-cambric insulation

G-E Geoprene portable cable and cord

G-E Flamenol railway signal and station control cable

G-E BX armored cable, BraidX nonmetallic sheathed cable and Flamenol building wire

G-E Formex and Deltabeston magnet wire

WRITE FOR INFORMATION

For facts on any General Electric wire or cable, write to your nearest C-G-E Office.

CANADIAN GENERAL ELECTRIC COMPANY
LIMITED

52-JA-18

Head Office: Toronto — Sales Offices from Coast to Coast

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 440*)

Scrap Metal Collection. — Scrap metal collection to make possible more iron and steel production in Canada is stressed by Maj. Gen. G. B. Howard, M.E.I.C., in the current bulletin of the Canadian Industrial Preparedness Association.

"Every possible effort is being made to increase our output of steel", General Howard states, "Of the steel we produce, something over 50 per cent is remelted scrap. Of that scrap, approximately half is purchased, the remainder being mill scrap. It is thus quite clear that if our steel output is to be expanded successfully, our supply of purchased scrap must also be augmented.

"Between the wars, scrap became available at a more or less stable rate. Motor cars were discarded, machinery was scrapped and replaced, old tools and fixtures were sold as scrap, since new material was readily available for replacement. The last war upset the equilibrium of the scrap market. Much steel and iron used for such defence purposes as shells, etc., cannot be recovered. Ships were sunk where salvage is either impossible or uneconomical. Other equipment was abandoned in inaccessible localities, and due to shortages most of us kept our cars, trucks and machinery, past the time when we would normally have discarded them. For these and many other reasons there is a world shortage of scrap iron and steel, at a time when we need more than ever for defence production and industrial expansion".

General Howard refers to the Canadian Scrap Iron and Steel Committee formed by the industry to conduct a scrap mobilization programme. His article concludes with, "It is in the direct interest of our members, as well as the Country at large, to assist this scrap salvage drive in any way possible."

•

Compressed Air Equipment. — A new development of the compressed air equipment for starting medium sized diesel engines has recently been put into production and will be fitted to a series of engines manufactured by H. Widdop and Company, Limited, of Keighley, Yorkshire, England. Due to the simplicity of the large diameter piping run, there is a considerable saving, it is claimed, in the cost of this pipe and in the cost of its manipulation.

The injector valve consists of an air relay operated by a pulse of air from the distributor. The air relay in the valve connects the main trunk line to the cylinder, so providing the turning force. At an appropriate point on the piston stroke the air is cut off by the distributor to the relay which closes the injector valves. The compressed air in the engine cylinder is then exhausted in the normal way. The distributor supplies relay air control to the injector valves to give a smooth and continuous starting effort until the engine fires when the compressed air supply is turned off.

•

Instrument Screwdriver. — Instrument makers and wireless mechanics often have occasion to assemble screws and nuts in inaccessible places. A special purpose screwdriver designed to overcome these difficulties is now available from Lewis Spring Company, Limited, Resilient Works, Redditch, Worcester, England, says the "Electrical Review". The screw is held for positioning by the forked end of the driver which is closed together and inserted into the slot of the screw. Similarly, small nuts can be held by the other end of the instrument.

•

Warp Knitting Machine. — No textile machine has aroused greater interest recently than the F.N.F. warp knitting machine made by F.N.F. Limited, Burton-on-Trent, Staffordshire, England, which, it is claimed, is capable of knitting a thousand courses (rows) a minute.

The most important feature of the machine is the patented needle and tongue assembly which is capable of higher operational speeds than the bearded needle of conventional design. The double eccentric units, too, which allow a fine degree of balance in all rotating and oscillating parts, and the elimination of all cams other than those of the pattern wheels, facilitate high speeds. Cantilever tension bars give yarn control at high speeds, while the patented let-off motion results in the delivery of a precise and unvarying amount of yarn regardless of the diameter of the beam, from the commencement to the completion of the beam.

•

(*Continued on page 464*)

SPRAY

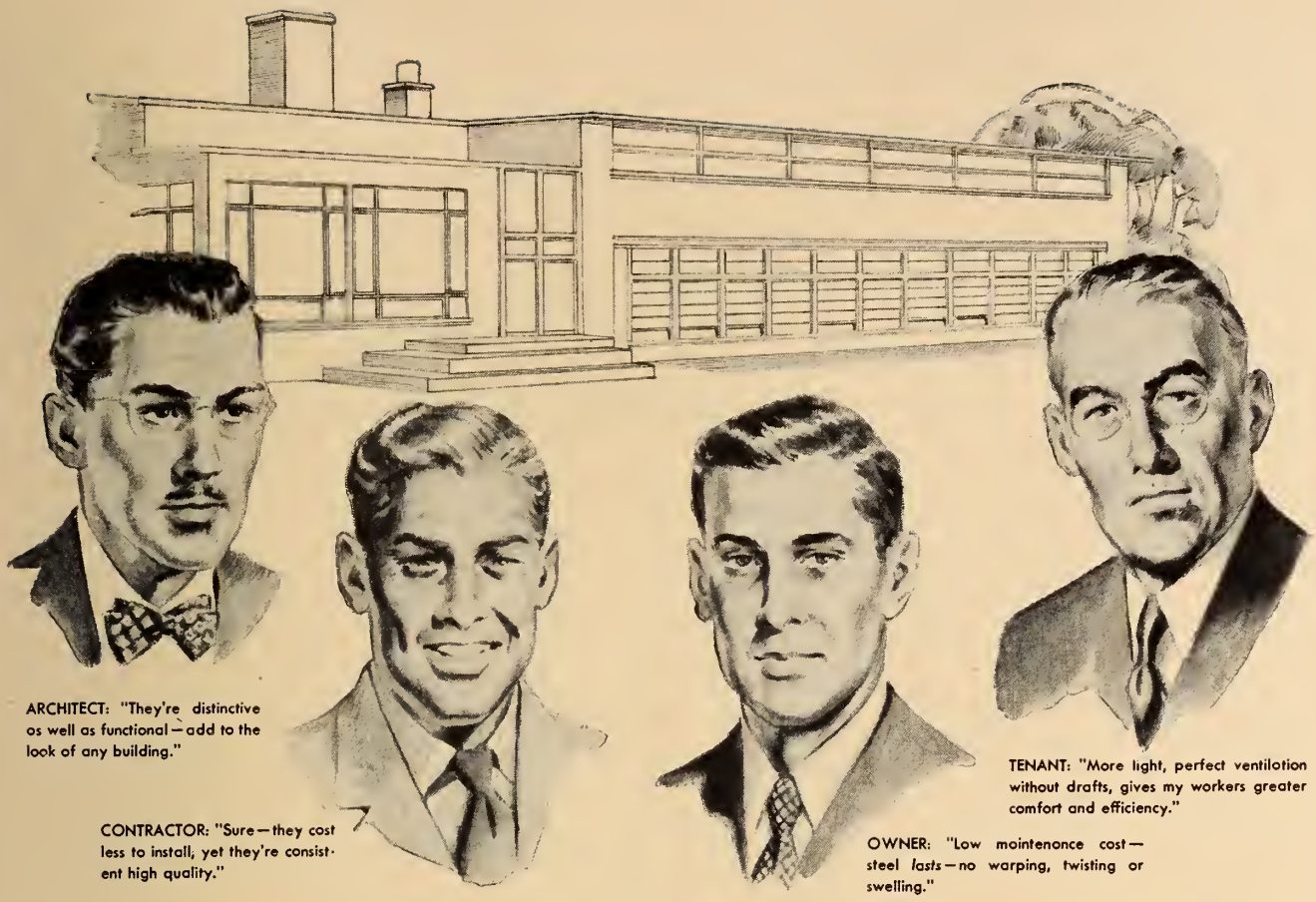
REMOTE CONTROL EQUIPMENT

For this power plant was designed by Canadian engineers and manufactured in Toronto

Under license from Control Corporation by

R. H. NICHOLS Limited

2781 DUFFERIN STREET • TORONTO 10



Architect, Contractor, Owner and Tenants agree on *Fenestra* windows

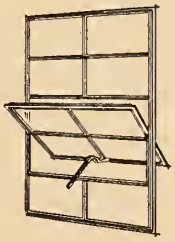
Fenestra Steel Windows offer these important advantages:

MORE DAYLIGHT: Frames are strong and rigid without being bulky, and so permit larger glass areas.

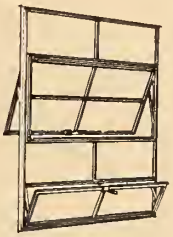
CONTROLLED FRESH AIR: Smooth-swinging vents protect against drafts, permit ventilation on even rainy days.

TRIPLE SAVINGS: Low First Cost, due to Volume Production. Low Installation Cost — Standardized modular sizes. Low Maintenance Costs — Steel *lasts!*

Investigate Fenestra Steel Windows *before* you lay out your window plans. Our specialist-engineers will be glad to help you plan your daylighting and aerating plans. Or, we will mail you our catalogue for your files.



PIVOTED WINDOWS



COMMERCIAL PROJECTED WINDOWS

INTERMEDIATE PROTECTED WINDOWS

2

CANADIAN METAL WINDOW & STEEL PRODUCTS LIMITED

139 Stephenson Ave., Toronto, 13 — 4862 Wilson Ave., Montreal, 29

BUSINESS AND INDUSTRIAL BRIEFS (*Continued from page 456*)

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

English Electric Journal.—The English Electric Journal is published by the English Electric Company Limited, Stafford, England. It is a highly informative publication which is issued at regular intervals by the British Company. No. 6 of volume 12 contains interesting items on new rail traction engines type "RK"; Governors and control gears for Diesel engines; the manufacture of asbestos-cement materials; design and operation of exhaust-driven turbo-compressors for diesel engines; the Napier "Nomad" Aero engine.

A limited number of copies of the publication are available in Canada and the English Electric Company of Canada Limited, St. Catharines, Ontario, will be pleased to advise Journal readers how these may be obtained.

•

Instrument Catalogue. — Minneapolis-Honeywell, Regulator Co. Ltd., has issued a new "Composite Catalogue" No. 5000. It consists of 28 pages and describes the principal instruments, control devices and related components manufactured by the industrial division of Minneapolis-Honeywell Regulator Co.

Specifications of approximately 100 measuring and control instruments, and valves are outlined. Included are several new designs including the differential controller and Tel-O-Set controller family.

Please direct requests to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, and ask for Catalogue No. 5000.

•

Magnesia Insulation.—"Precision Magnesia Insulation — as developed in the New Ehret Magnesia Plant at Valley Forge, Pa." — is the title of an article reprinted from the Chemical Engineering, by The Kuljian Corporation, 1200 North Broad Street, Philadelphia 21, Pa. Copies of the reprint may be obtained by applying to the Company.

•

Air Conditioning Catalogue.—Canadian Blower and Forge Company, Limited, Kitchener, Ont., has issued a new bulletin — No. 3703-A which covers their new model "G" Air conditioning units.

These units are completely new in design throughout, engineered to suit specific requirements.

The Model "G" fan incorporated in the units is entirely new in fan design, manufacture and performance. Details of the fan are outlined in the bulletin, the main features being:—light weight, quiet in operation, and high in efficiency—performance is stable over a wide range—oversized hollow shafts—bearings mounted outside the cabinet for ease of servicing.

The bulletin has been arranged to carry as complete engineering and descriptive data as possible. It is punched so that it may be filed in a catalogue binder. Write to the Company for copies.

•

International Nickel Publications. — Revisions in the International Nickel bulletin on "Machining Nickel Alloys", have been made. The bulletin designated as number T-12 has been reprinted with additions to and revisions of information on both wrought and cast materials.

A new technical bulletin recently issued by the Company embodies all the information currently available on joining Inco alloys by silver brazing, copper brazing, Nicrobrazing and soft soldering. Questions on design, precleaning, alloys, fluxes, atmospheres, heating methods and inspection are covered. This bulletin is known as the T-34.

A 22 page reference manual on the properties of Duranickel and its application in industry is being made available to airframe and aero engine manufacturers. The manual gives information

LINK-BELT RESEARCH AND ENGINEERING . . . . WORKING FOR CANADIAN INDUSTRY

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Millions of tons of bulk materials now ride on belt conveyors engineered and built by LINK-BELT

For bulk materials handling, belt conveyors provide remarkable initial economies. And in many cases operation and maintenance cost far less than any other method of transportation.

Belt conveyors handle huge tonnages, because the material runs at high speed in a continuous stream—24 hours a day, if desired.

Initial cost is low, because there is no need to carve out hills or fill in low spots —no need for heavy bridges over obstructions. Belt conveyors are light in weight and operate in narrow or low passages . . . up or down steep grades. They are inherently long-lived, requiring little maintenance.

Link-Belt is a nation-wide organization with broad experience in the engineering, manufacture and installation of materials handling and power transmission machinery. Link-Belt is prepared to take care of every detail from planning through erection.

◀ *Link-Belt Belt Conveyors handle titanium ore and coal from boats or railroad cars to storage or to smelting plant at Quebec Iron & Titanium Corporation's new smelting plant at Sorel, Que.*

12,748-A

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GENERAL CONTRACTORS & ENGINEERS

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HIGHWAYS
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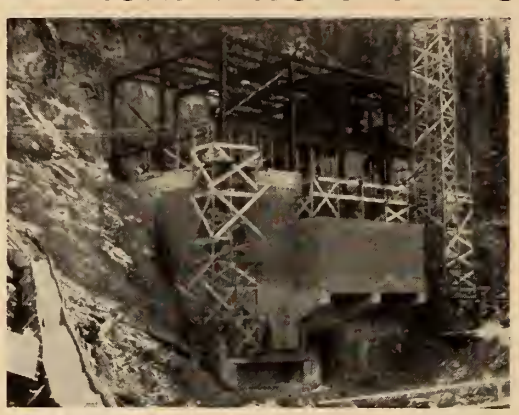
Main Spray Power Plant under construction for Calgary Power Ltd.

CONTRACTORS FOR WESTERN CANADA

EDMONTON - CALGARY - REGINA

on the mechanical properties, shear strength, endurance limit, impact strength, spring properties, working characteristics, corrosion, mill forms, and applications. This publication is designated as T-32.

For copies of any of the above publications, which are available to *Journal* readers, without charge, apply to the International Nickel Company of Canada, Limited, 25 King St. W., Toronto.

•

Radiation Instruments. — Canadian General Electric Company, Limited, 212 King St. West, Toronto, have issued a new 8-page bulletin on G-E Radiation Instruments.

The bulletin is in two colours and contains essential information on ten recent nuclear radiation detectors.

Designated as GEA-5735 this publication is available without charge. Apply to the Company for copies.

•

Leeds & Northrup Catalogue. — Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, 44, Pa., have revised their catalogue covering Galvanometers and Dynamometers. A copy of the revised catalogue — Section ED "Galvanometers and Dynamometers" will be forwarded on request. Address requests to the address given above.

•

Tachometer Bulletin.—The Metron Instrument Company has announced a new data sheet No. 42 HJK pages 1 and 2. It describes ¼ per cent accuracy tachometers for making high accuracy speed measurements with convenience otherwise unavailable in a continuously indicating switchboard instrument. Write to the Company at 432 Lincoln Street, Denver 9, Colorado.

•

Industrial Tapes.—More than 20 electrical tapes for industrial uses are described in a new booklet and sample card available, at no charge, from Minnesota Mining and Manufacturing of Canada Limited, London, Ont.

Entitled "Speed Production, Improve the Product" the booklet illustrates several uses and applications for various thermoplastic and thermosetting tapes. Properties of the tapes are listed in a table for quick reference and are classified according to types of backing, thinness, tensile strength, elongation, adhesion, insulation resistance, dielectric strength and electrolytic corrosion factor.

The sample card has samples of 24 of the most common "Scotch" electrical tapes and lists properties of each. For charts and samples write to the Company at P.O. Box 757, London, Ont.

•

Backwash Filters.—Hardinge Co., Inc., 240 Arch Street, York, Penna., has issued a new bulletin on automatic backwash filters. The filter has a compartmented sand bed and a travelling backwash mechanism, which cleans one compartment at a time, while the rest of the filter bed operates normally. No shut-down or change-over is necessary for backwashing. The following applications are discussed: industrial and municipal water supply, paper mill "white water" recovery, sewage and industrial waste treatment. For copies write to the Company and ask for bulletin No. 46-A.

•

(*Continued on page 469*)

MANNING, MAXWELL & MOORE, Inc.
FISHER GOVERNOR COMPANY
DANIEL ORIFICE FITTING CO.
Barber ENGINEERING & SUPPLY CO. LTD.
CALGARY
EDMONTON

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 466*)

Elevator Co. Periodical.—Turnbull Elevator Company Limited, 126 John Street, Toronto, Canada are the publishers of a magazine "Going Up". It is published bi-monthly.

Of a semi-technical nature the publication describes recent installations made by the Company and there are also articles dealing with problems pertaining to elevator installations, maintenance and performance. To be placed on the mailing list for regular receipt of this publication communicate with the Company.

●

Canadian Allis-Chalmers Bulletin. — Canadian Allis-Chalmers Limited, P.O. Box 37, Montreal, Que., have recently released a new sheaves bulletin for V-Belt Drives from 15 to 75 hp.

The bulletin has 8 pages of information covering dimensions and construction features of C section Magic-Grip sheaves with split taper bushing for positive clamping of the shaft. Included in the bulletin are easy drive selection tables which cover every possible combination of stock C section sheaves for drives from 15 to 75 hp. ratios 1:1 to 6.25:1. Also included are price list of C section Magic-Grip sheaves and C section Super-7 Texrope V-belts. Write to the Company for copies and ask for No. CAC6043.

●

D.C. Power Supply. — The Superior Electric Co., Bristol, Connecticut, has recently released a new bulletin describing the Varicell D-C Power Supply.

The bulletin describes in detail the Varicell, a source of variable stabilized-regulated d-c voltages operating from a-c power lines. The bulletin is complete with photographs, circuit diagrams, outline dimensions, ratings and other descriptive data. Copies may be obtained by asking for bulletin V1051. Inquiries should be addressed to R. F. Greene, at the address given above.

●

Soil Compaction Data.—"Cost data for soil compaction in restricted areas" is the title of an interesting, new, technical bulletin which has been prepared for contractors and construction engineers by Barco Manufacturing Company, 1801 Winnemac Avenue, Chicago 40, Ill. The cost figures quoted in the bulletin are based on a survey of actual jobs and are intended to be helpful to contractors in preparing bids and maintaining cost records.

In addition to covering direct cost items such as depreciation, interest, insurances, taxes, fuel and repairs, the bulletin discusses overhead charges and possible variations in conditions on jobs. Copies may be obtained by applying to the company at address given above.

●

Chain Belt Bulletin. — A new bulletin for the cement and rock products indusdustries featuring Rex elevating, conveying and power transmission equipment has just been published by Chain Belt Company of Milwaukee, Wis.

The book contains much useful information on drive and conveying chains and bulk handling equipment for the industry. It is a well-produced publication and the information is concise and illustrated by a photograph and drawings.

For copies apply to Chain Belt Company, Department PR., Milwaukee 1, Wisconsin. Ask for bulletin 52-53.

●

Hand Pyrometer.—A new hand pyrometer with two scale ranges for the rapid and convenient measurement of surface, liquid, gas and molten metal temperatures is available from Canadian General Electric Company's Meter and Instrument Section.

Designated as Type FH-1, the new pyrometer is especially useful where a temperature detector does not need to be installed permanently. Its two scale ranges are 0-500 F and 0-1500 F, and the change from one scale to the other is accomplished by the movement of a switch. Typical applications include temperature check of plastic moulds, ovens, alloys with low melting points, and pre-heated metals for welding. Ask for bulletin GEC-836. Address requests to Canadian General Electric Company Limited, 212 King St. West, Toronto.

●

Business Trend Chart. — Cleveland Tramrail division of N. C. Sherman Limited, 1156 West Pender Street, Vancouver 1, B.C. offer copies of "Business Trend and Progress" chart. This chart

Greetings to Delegates

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provides a "Seeing at a glance" guide to questions pertaining to economic trends. Many new features have been incorporated in this new 1952 edition. For example there is a graphic presentation of the purchasing value of the dollar and illustrations are included to show the rise and falls since 1914. Hourly wages are depicted from 1840 to the present average. A review of the important role of consumer credit is also shown. Data on national income, business activity, commodity prices and stock averages are given.

As Canadian statistics closely parallel those of the United States this data sheet should be of great interest to a number of readers. Write to the Vancouver Company for copies.

●

Dimming Equipment. — The Superior Electric Company, Bristol, Connecticut, manufacturers of light dimming equipment has released a new 12 page bulletin featuring the complete line of standard non-interlocking types of "Powerstat" Dimmers.

This bulletin describes in detail the advantages claimed for the Company's products. For copies write to Superior Electric Company, Bristol, Connecticut. Ask for bulletin D851N.

●

Sly Bulletin.—The W. W. Sly Manufacturing Co., 4700 Train Avenue, Cleveland 2, Ohio, have just released a new bulletin describing their new "Sly Dynaclone". This is a new cloth screen dust filter. Ask for bulletin No. 101.

●

Thresholds.—Engineers concerned with design, application or purchasing of thresholds will find very complete information in a 28 page pocket size book, which may be obtained from Wooster Products, Inc., Wooster, Ohio. The publication contains complete descriptions of the various tread surfaces manufactured by the Company.

●

Corrosion Problems. — Recently released is a highly interesting and informative catalogue from Acme-Fisher Division, Broadway Rubber Corporation of Louisville. The book contains 14 pages of technical and general information which will be of interest to those concerned with the problems of corrosion in industrial equipment. Write to Acme-Fisher of Texas, Limited, P.O. Box 15066, Houston 20, Texas.

●

Thermometers. — The entire line of general purpose and specialized Thermohm (resistance thermometers) that are being used in many plant and laboratory applications to detect temperatures between —325 and plus 1000 deg. F. with accuracies of from plus or minus 0.018 deg. F. to plus or minus 3.0 deg. F. are fully described in a new, 36 page catalogue "Thermohms, Assemblies, Parts and Accessories", just published by Leeds & Northrup Company. Write to the Company and ask for Catalogue EN-S4. The address is Leeds and Northrup Company, 4934 Stenton Avenue, Philadelphia 44, Penna.

●

Cleveland Model 80.—The Cleveland Trencher Co. has just published a 4-page, 2 colour 8½ x 11" bulletin on the Cleveland Model 80 Backfiller-Tamper-Side Crane. Write to Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio, and ask for the Cleveland Model 80 bulletin.

●

Pulley Lagging.—The new "B. F. Goodrich Striplag Pulley Lagging" has been announced by the B. F. Goodrich Rubber Co. of Canada Ltd. This new type of rubber Pulley Lagging is claimed to have many advanced features and it can be applied easily and quickly right on the job to any size of pulley. A simple formula makes sure of an exact fit on any conveyor pulley. Increased friction coefficient between belt and pulley is claimed and longer belt and pulley life is also claimed because abrasive friction is eliminated. Write for an illustrated catalogue to the Industrial Products Division, The B. F. Goodrich Rubber Company of Canada, Limited, Kitchener, Ont. Mention "Striplag" in your request.

●

Rustproofing. — A chemical treatment designed to produce an oil-retaining rustproof surface for moving metal parts, is described in a new 4-page publication released by Octagon Process, Inc., 15 Bank Street, Staten Island 1, New York. Printed in 2 colours the booklet discusses application methods and advantages claimed by the Company for its "Rustshield 2" on sliding and bearing surfaces. Copies of the booklet will be forwarded on receipt of request.

●

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Appointments and Transfers

H. C. Hamon.—The General Electric X-Ray Corporation Limited has announced the appointment of H. C. Hamon as industrial specialist for Ontario and Quebec. He has represented the Company in the Montreal area for the past 20 years, and has had extensive experience in the medical and industrial x-ray industry.

●

Hewitt Equipment Ltd.—Hewitt Equipment Limited, recently appointed Caterpillar Tractor Company representatives for the Province of Quebec, have secured temporary premises at 1245 St. Urbain Street in Montreal. In Quebec City the new Company has purchased the facilities and building formerly operated by Just Equipment & Supply Co. Ltd., at 1125 rue de la Canardiere.

Plans are under way for the construction of a modern service shop, parts depot and sales office in Montreal.

●

Aerol Appointment.—Plant Equipment Company, Room 201—145 Yonge St., Toronto, have been appointed distributors for Canada by the Aerol Co., Inc.

●

C. H. Allen

C. H. Allen.—Charles H. Allen has been appointed industrial sales manager of the Montreal district of Canadian Westinghouse Company Limited.

He joined the Company in 1924. After a training course he was transferred to the service department, where he was responsible for the erection of switchgear and control equipment in many large power houses. Before his present appointment he was with apparatus sales staff in Montreal.

●

R. A. Crichton

R. A. Crichton.—R. A. Crichton has been appointed industrial sales manager of the Toronto district by Canadian Westinghouse Company Limited.

Mr. Crichton joined the Company in 1949 as manager of lamps, tubes and lighting, Ontario district. In 1950 he was appointed special representative of the Ontario district manager. He is a graduate in electrical engineering from Edinburgh University, Scotland.

●

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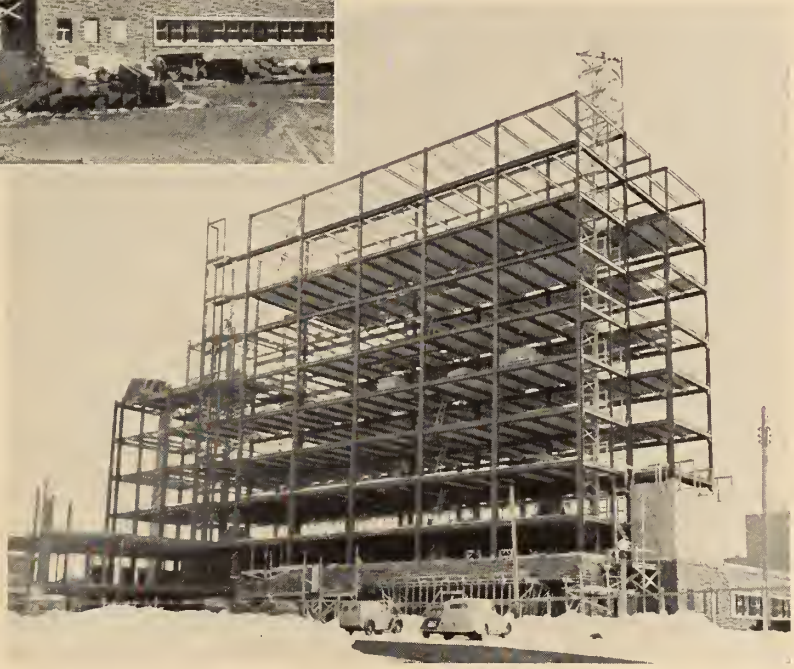

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E.I.C. Technical Papers

The Institute maintains a fund for the separate publication of high-calibre original technical papers. Interest in such papers is limited to a relatively small audience of specialists in the subjects to which the papers relate, and it is not economically sound to publish them in the *Journal* which aims at the interest of some 14,000 engineers in all branches of the profession.

The publications committee invites authors to present such manuscripts for submission to qualified reviewers and publication if warranted. Written discussion will be accepted and published as supplements.

Technical papers issued to date are:—

No. 1—Flow in Conduits and Canals:—*French and Wood.* Comprises tables and diagrams for the solution of problems of flow in open and closed channels. Price . . $1.50

No. 2—A Revised Manning Flow Formula:—*Blench.* A discussion of the various hydraulic flow formulae in use or proposed. The author, formerly Director of Irrigation Research, Punjab, Pakistan, and now on the staff of the University of Alberta, concludes that the Manning formula, with modifications, is the best now available. Price . $1.00

No. 3—Air Entrainment by Water in Steep Open Channels:—*Priest.* A theoretical solution of a problem of interest to hydraulic engineers. Price $1.00

No. 4—Graphical Solution of Partial Differential Equations with Engineering Applications:—*Wood.* Solution by simple, almost automatic, methods, of equations arising from the study of water hammer phenomena, impact, and other common engineering problems. This paper will be of particular value to hydraulic engineers and structural and machine designers. Price $3.00

No. 5—Economy in Rigid Frames:—*Monti.* Charts and diagrams to facilitate rapid preliminary design of the common types of rigid frames, eliminating the cut-and-try methods previously necessary before a final analysis could be attempted. This paper belongs in the library of every structural designer. Price $1.00

●

N.B.—Remittance with order please, payable at par in Montreal.

NEWS OF THE BRANCHES

(*Continued from page 402*)

the Seattle Chapter to visit Vancouver at that time.

The meeting ended with folk dancing, and card games for those not so athletically inclined.

All seemed to be agreed that the day was a complete success and that congratulations were due to the Seattle Chapter for arranging such an interesting and entertaining program on this occasion.

Winnipeg

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

Electrical Section

J. G. Dickinson, Jr.E.I.C.,
Branch News Editor

February Meeting

The Electrical Section, Winnipeg Branch, at a meeting held February 7, were favoured with a very fine paper presented by Mr. R. A. Harvie, entitled, **Cold Rolled Steel at 3300 feet per minute.**

Mr. Harvie is manager, Industry Application Department, Canadian Westinghouse Company Limited, Hamilton, Ontario.

Possibly few realize the importance of cold rolled steel and the considerable amount of engineering done in Canada to make its manufacture possible. For those who did not know, it was learned that cold rolling gives steel the unique characteristic which makes it suitable for uses such as tin cans, automobile and truck bodies, roofing and all sorts of containers. Several hundred thousand tons of cold rolled steel are produced each year at the Stelco plant, Hamilton. The steel produced is tinplate (.006"-.015") and sheet (.015"-.074").

Mr. Harvie's talk centered mainly around the 5 stand tandem cold reduction strip mill. A brief review of the whole operation was given first and followed by a very complete and enlightening description of the tandem mill and the engineering aspects of it.

The tandem mill at Hamilton consists of five stands which are spaced at 13 foot centres. Each housing column is 29 in. square, which is necessary to hold under the tremendous rolling pressures which range from 60,000 to 100,000 pounds per inch of strip width, depending upon gauge. Because small diameter (21") work rolls will do the same work at lower pressure and less power, they are used and are backed up by larger rolls (53") to minimize roll deflection. Sheet and tinplate up to about 49 in. wide is possible.

The work rolls and back up rolls are separated by hydraulic jacks. Two screws per stand provide the force to move the rolls together. A 50-hp. d-c motor powers each screw. A magnetic clutch connects the two motors of each stand so that the two screws can be operated separately or in unison.

The lower work rolls are driven directly at motor speed. The upper work rolls are driven at the same speed and in opposite direction through a helical gear and spindle. The back up rolls are driven by direct contact with the work rolls. The d-c motor driving the rolls of each stand vary in horsepower and speed. Stand 1 is driven by a 1500-hp. d-c single armature 70/175 r.p.m. and that driving stand 5 is 3000 hp. double armature wound 250/625 r.p.m. The reel motor is 800 hp. rated and variable between 175/700 r.p.m. The motors are selected and designed with great care. Energy consumption curves from test data and power calculations for representative rolling schedules are used to determine the motor hp. rating. The speed ranges of each motor are selected by working out rolling schedules for various products and plotting the schedules. The speed cone of the mill shows the schedules of which the mill is capable.

The inertia (WR^2) of each motor is also very important because accelerating and decelerating times must be very short or productive output of the mill will suffer. Also, in cold rolling the sheet goes off gauge as the mill slows down, resulting in large amounts of scrap steel if the decelerating time is excessive. The Hamilton mill was designed to accelerate or decelerate between thread and top speed of 3,300 f.p.m. in six seconds. In emergency it can stop in 4 seconds. To bring down WR^2, the motors of stands 4 and 5 have a double armature which is connected in parallel.

All mill motors are located in a separate room, together with the M G Sets and exciter sets associated with the mill. A blower system circulates air through the machines and keeps the motor room under a pressure slightly above atmospheric. All incoming air is cleaned.

Six entirely separate variable voltage Ward Leonard systems are used. Circuit breakers with overload trips are included in each positive bus and contactors in each negative bus. Dynamic braking circuits are provided to stop each mill stand should the stand circuit breaker open. The generators for stands 1, 2 and 3 with reference exciter are assembled into a motor generator set driven by a 7,500 hp. synchronous motor. The generators for stands 4 and 5 and the reel, together with a constant potential exciter are assembled into a second M G set driven by a duplicate 7,500 hp. synchronous motor.

The stand "rototrol" speed regulators work through the generator field exciters to adjust generator voltage so as to maintain exact synchronization of stand speed at all speeds and during accelerating and decelerating periods.

Six switch boards mount individual central items for each of the five mill stands and for the reel. By simple palm operated pushbuttons the operators have over-all mill control which consists of the 14,300 hp. of connected driving motors.

Mr. Harvie ended by commenting that it was modern electrical control and an electrical drive which made the huge precision machine possible and that even larger and better ones are needed. This is a great challenge because engineers of advanced mechanical and metallurgical and electrical skills are needed to make it possible.

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"To facilitate the acquirement and interchange of professional knowledge among its members, to promote their professional interests, to encourage original research, to develop and maintain high standards in the engineering profession and to enhance the usefulness of the profession to the public."

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15,500 copies of this issue printed

A Message from The President

My first word to the more than fifteen thousand members of the Institute is one of deep and humble appreciation of the high honour that has been conferred upon me by reason of your having placed me in office as your President.

During my long association with our Institute, I have come to the realization that there is considerably more than honour involved in carrying out the duties of any of the Institute senior officers. In addition to bestowing upon your President the greatest honour in your power, you place in his hands a grave responsibility, one that can only be met adequately by means of the fullest co-operation and assistance of all of the other officers and members of this organization. I look forward with confidence to securing this co-operation in the fullest measure.

Happily, there seems to be a growing realization in our far-flung membership that mere "belonging" to our organization is not enough. Passive membership in this or any other group is not only bad for the member himself but equally bad for the group.

One of the gratifying things about the increasing volume of *active* members is the working participation of the younger engineers in Branch affairs and indeed, what is extremely important, affairs outside their immediate professional duties on the community, civic and national level. As someone said recently at an Institute meeting, it is becoming quite an ordinary thing to see a man's advancement in his profession keeping pace with his progress in extra-curricular activities.

A splendid increase in a number of branches in recent years has provided an excellent opportunity for an increasing number of *active* participants in Institute work and further increase in the number of branches is confidently expected to widen the opportunities for this work still further.

During the forthcoming year it will be my privilege to see many of you at your Branch centres. This renewal of friendships and acquaintance with old friends, and the prospect of making many new friends coupled with the opportunity of discussion of Institute affairs, and of being at your service, will be a rare and unique pleasure. I am already looking forward to it.

J. B. Stirling

President.

Precast Reinforced Concrete Building Frames

by

E. M. Rensaa, M.E.I.C.

Main, Rensaa & Minsos,
Engineers and Architects,
Edmonton, Alberta.

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

This paper discusses the technical and economic aspects of precasting and joining reinforced concrete beams and columns. Floor sections and wall panels are not dealt with. The methods herein described have been recently used in Edmonton, on the New Avenue Theatre, and on the South Side Bus Depot for the City Transit System. The author emphasizes that precasting does not replace cast-in-place construction, except in special cases such as those here described, where substantial savings can be effected.

Reasons for the Use of Precast Members

Let us assume that concrete costs $12.50 per cubic yard delivered at the building site or mixed there. This initial cost will vary somewhat according to locality. Some saving may be made in the initial cost by using well proportioned aggregates and low water content so that the required strength can be obtained with a minimum amount of cement. A certain saving may also be made by a well laid out mixing plant requiring minimum handling of cement and aggregates. It is easily seen, however, that the initial cost per cubic yard will only vary by a few dollars and the possible saving be of relatively small importance for ordinary jobs.

Let us further assume that the concrete for high columns and frame will cost $50.00 per cubic yard in place including form and scaffolding material and labour, but excluding reinforcing steel. This cost may easily be reached or exceeded for high frames where concrete is cast in place. The point is that the cost of concrete in place may be four times that of the concrete delivered or produced at the site. It is further clear that the additional cost of $37.50 per cubic yard for getting the concrete into its final position consists of labour and material for forms and scaffolding. This material, which is largely wasted, does not form part of the finished structure. Under these circumstances, it is easily seen that a labour or form saving device in concrete placing may pay off handsomely.

In the past, much thought has been wisely given to the problem of reducing the cost of making concrete. Much has been accomplished along these lines by using a low slump, thereby saving cement, and by properly organizing the work of placing concrete. But our final objective, naturally, is to reduce the cost of concrete in place. When tackling this matter from the standpoint of reducing the cost of producing the concrete, the possibilities of economics are decidedly limited, because the figure we are working with is low, in this case $12.50. But by endeavouring to reduce the cost of placing the concrete in the structure there is a much greater opportunity of saving more, as we are dealing with a larger sum of money, in this case $37.50. We have found that by precasting the concrete either on the ground at the site of construction, or in a concrete products plant, a very considerable portion of this $37.50 can be saved.

Precasting usually shows worthwhile economics when the following conditions are obtained;

1. Many members of the same size (mass production).
2. High frames (involving costly form work and scaffolding if concrete is to be poured in place).
3. Accessibility on building site for erection machinery.
4. Members of such weight that they can be readily hoisted into place by available equipment.

The first condition is, of course, of primary importance. It will not generally pay to make a casting platform and bring in expensive hoisting equipment for only a few precast members. Uniformity of size is not quite as important, as forming on the ground is much simpler than forming up in the air.

Precasting in a concrete products factory with thoroughly experienced men and the most suitable machinery may mean further saving if the length of transport to the site is reasonable. To the cost of fabrication will have to be added the cost of hoisting and placing the members. The total cost of concrete in place will still, under favourable conditions, be much below that of standard cast-in-place concrete.

The cost of cast-in-place concrete increases considerably with the storey

Fig. 1. Placing beams. Bus Depot, Edmonton Transit System.

height of building frames, because of the necessity of stronger bracing and higher scaffolding. The rise in cost for increased storey height is not nearly as great for precast construction. It does not make much difference whether a member is hoisted 10 feet, 20 feet, or more, as long as it is within reach of the hoisting boom.

Accessibility for erection purposes is of primary importance, and lack of such may make the use of precast members impracticable. The floors must be strong enough to carry the hoisting equipment and there must be sufficient space available to reach all points where members are to be placed.

The availability of hoisting equipment, and charges for such, is a major consideration. On small and middle sized jobs where it will not pay for the contractor to buy special equipment, it is necessary for the consulting engineer to find out what equipment may be obtained in the locality. The weight of members which he may employ will then be limited by the capacity of this equipment.

Other advantages of precast construction are:

1. Saving of form lumber, scaffolding material and labour.
2. Concrete when cast in a horizontal position on a platform can be made of much better quality than cast vertically in place. A very low slump concrete requiring less cement may be used to obtain a specified strength, or a higher allowable stress may be used. High strength concrete will generally be most advantageous for precast work.
3. The precast members may be made in a protected place and, if desired, during the winter months. Curing of members is very easy, and a better finished product is therefore possible.
4. Most of the shrinkage has taken place before the members are erected and contraction joints are, therefore, in most cases either unnecessary or may be placed comparatively far apart.
5. Work on precasting columns and beams may be carried out independently of foundation work, and the members can be ready for erection when the foundations are ready for receiving loads. Considerable saving in construction time may be made in this way.
6. There are no form supports or scaffolding to hinder the work on construction of curtain walls or work on the ground. Masonry work can, therefore, be carried on as soon as the columns are erected and, if desired, before the beams are placed. This procedure was used on the construction of the South Side Garage.

Precasting is not always practicable—the principal disadvantages are as follows;

1. It is very difficult, and in many cases impossible, to obtain the same degree of continuity as in cast-in-place construction.
2. Precast framework is not so suitable for multi-storey construction, due to difficulty of column connection and the placing of heavy lifting equipment on elevated floors. The latter disadvantage generally applies to more than two storey buildings.
3. Precast framework is, as a rule, only economical for fairly large buildings with regular column spacing.
4. Weight of members is limited by the available lifting equipment.
5. The design of precast buildings requires much more skill and

Fig. 2. Beam joint. Bus Depot, Edmonton Transit System.

special knowledge than does conventional design.

Continuity in Precast Construction

As mentioned above, one of the disadvantages in precast construction is the difficulty in obtaining continuity of connections cheaply and efficiently. Most of the precast designs used in Western Europe and the U.S.A. are statically determinate systems, having joints with practically no continuity. It is true that such simple systems have certain advantage, among which might be mentioned:

1. A minimum of work on the joint after erection.
2. Erection in cold weather is facilitated, as little or no cement mortar is required for the joints.
3. Temperature and shrinkage stresses are practically eliminated, as small movements in the joints can usually take place.

The statically determinate systems have, however, the following serious disadvantages which, in the writer's opinion, in many cases far exceed the advantages, namely;

1. Statically determinate beams are much heavier than continuous ones for similar span lengths.
2. Cracks may develop at the joints in such a way that roofing or covering is damaged.

When, in 1948, the design was started for the New Avenue Theatre, the writer gave much thought to the problem of continuity. A design of beam connection was then developed which provided continuity after placing of beams. The beams would act as though simply supported for their own weights, and for any load brought on them before the joints were fixed. That is a very favourable condition because the positive and negative bending moments will be more nearly equal, which in most cases is very desirable. A large number of projecting top bars are very inconvenient at the supports for placing and joining precast members. No cracks or other signs of weakening have been observed in this type of joint designed by us. Figure 1 shows the placing of beams at the Bus Depot.

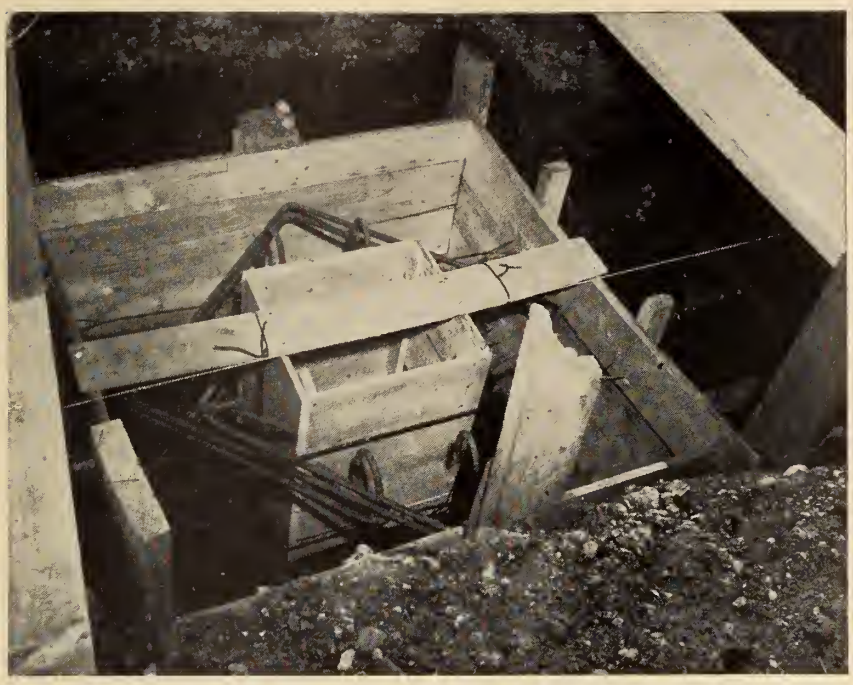

Fig. 4. Footing form and reinforcing. Bus Depot, Edmonton Transit System.

The question of whether to make the connection by welding or by overlapping of bars has also been considered rather carefully. We think that welding all steel necessary for the negative bending moment, in most cases, will cost considerably more than overlapping, especially when the inconvenient position for doing welding work is taken into account. It is also, in the writer's opinion, undesirable to weld reinforcing steel at points of maximum stress. To form and place the small amount of key concrete requires comparatively little labour, so the advantages obtained by this joint are certainly worthwhile. Figure 2 shows the joint just after the beams have been placed, and before the stirrup ends have been bent down ready for placing side forms for key concrete. Figure 3 shows part of Auditorium frame at the New Avenue Theatre. Forms for joint concrete are still in place.

Fig. 3. Auditorium frame. New Avenue Theatre.

Precast Columns

The problem of fixing a column to its foundation in an economical and practical way is generally much more difficult to solve than connecting the beams to each other. In large one or two storey structures using precast framing, it is as a rule most convenient to provide stability against wind loading by fixing the columns to their foundations. The writer has seen many designs attempting to solve this problem of connection, but hardly any design, which so far has come to his attention is univer-

sally applicable or sufficiently economical. There is no great difficulty in obtaining either strength or economy separately, but combining these two qualities is most difficult to achieve. The wall columns around the auditorium in the New Avenue Theatre are 24 feet high, and are fixed at the lower ends to the foundations. Pockets 30 inches deep were provided in the foundation blocks for the purpose of fixing the lower ends of columns.

Columns were placed in these pockets, then plumbed and lined up temporarily by means of wedges. The 2 inch wide free space allowed around the column was then filled and packed with a fairly dry concrete mixture. This method of fixing a column is very strong as we had an occasion to find out when one column was hit by a heavy truck. Column and truck received damage, but no loosening at the column foot connection was observed. In the Bus Depot the depth of column pocket was 24 inches. The calculation of stresses in such a column connection was described by Professor Kleinlogel in the German periodical "Beton und Stahlbetonbau" in 1944. This connection will in the following be designated the German type.

In spite of the reliability of such a column connection, it is easily seen that the foundation requires much extra concrete, and the system can only be used where there is no storey underneath. There must also be space available on all sides for the footing block. This would generally prevent the outside wall from being placed against a boundary line. In the case of the New Avenue Theatre, eleven columns on the front side were placed directly on the foundation wall, and keyed to this by special mortar filled joints on two sides. The connection was very cheap, but did not have the same lateral strength as the German type. This was not necessary for that case (Figure 6).

During the year between the construction of the New Avenue Theatre and the Bus Depot, the writer searched through European and American literature, in an endeavour to find a cheaper and more applicable column joint. No satisfactory solution was found, however. The desirable requirements we proposed for a good joint were as follows:

1. A minimum of extra material
2. Maximum lateral bending strength
3. Speed of erection, requiring a minimum of bracing in the time interval before final fixing.

A considerable number of designs were made, but found lacking in one or more of the above requirements. Just before completion of the drawings for the Bus Depot, the writer at last arrived at a solution which seemed satisfactory. It appeared, however, to be too risky to make general use of this connection without preliminary tests. There were some columns over the furnace room under the main floor where the German type of column connection could not be used, and four of these were selected for test purposes. The result was most encouraging. While the time required for the hoisting crew to set and fix a column of the same size of the German type would be about twenty minutes, the time required to set and plumb each of the four test columns averaged eight minutes. Some improvements and additional alternatives have since then been made to the design.* Figure 7 shows the type of connection used for the four test columns at the Bus Depot. This type of connection can be used for

*Patents applied for.

Fig. 5. Placing columns. Bus Depot, Edmonton Transit System.

Fig. 6. Keyed columns. New Avenue Theatre.

multi-storey construction and, as all parts lie within the column section, there is hardly any location where the column cannot be placed. With the latest improvement containing levelling screws no shoring is necessary, and the time required for erection is expected to be an absolute minimum.

It may be said that economies available due to precasting columns fixed at the lower end, as compared to casting them in place, will be less than for precast beams. However, saving in time, and avoidance of obstructing form work, may still make the use of precast columns profitable.

Time Required for Erecting Precast Beams and Columns

It is important that the time required for the crew and hoisting machine to place precast beams and columns will be a minimum, so connections must be designed with this in mind. Methods of connection which might be technically usable, but do not allow the requirement of speed, may decrease the saving of precasting to little or nothing. It does not matter so much if a little extra work by one or two men is required later to complete the connection when this does not involve any delay in the more expensive machine work. The time required for placing and securing heavy columns with the German system of footing averaged twenty minutes, both at the New Avenue Theatre and at the South Side Bus Depot. At the former, eleven small columns were placed in a total time of one hour and twenty minutes. Fairly heavy columns with the new type of footing connection required about eight minutes each for erection. Beams weighing two to three tons required ten to fifteen minutes for erection on both jobs.

Economy of Precast Frames

It will be seen that it is not possible to make a general statement about what savings may be obtained by precasting structural framing. In the case of the New Avenue Theatre, the contractor kept accurate cost figures for the frame itself, and made an estimate of what the cost would have been for ordinary cast-in-place concrete. He found a saving of 69 per cent in labour and lumber for forms and scaffolding for the high auditorium frame, and 52 per cent saving for the 11.5 foot frame in front of the building. The saving of the 69 per cent would be somewhat reduced for the high frame, due to more expensive column foundations, so perhaps a saving of about 50 per cent would be more accurate. It was assumed that the cost of concrete and reinforcing steel delivered at the site would be the same for both precast and cast in place construction, so these items are not included in the comparisons. The cost of getting the concrete into final position was, in other words, reduced by

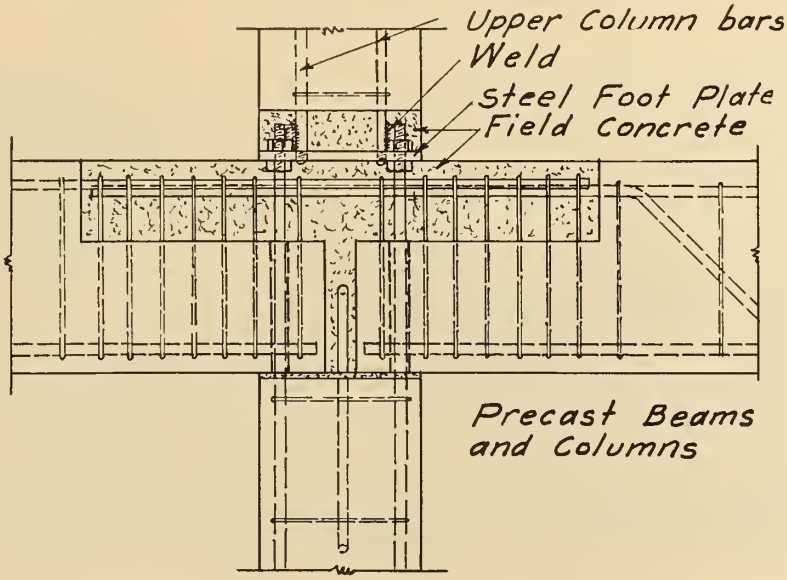

Fig. 7. New column connection.

one half compared to standard cast-in-place methods. It should be mentioned, however, that the contractor worked very efficiently and in close co-operation with our firm.

We do not know what savings were made with precasting at the Bus Depot, but the contractor's tender for the structure itself was much below our estimate. It was also a mixed type of construction with a considerable amount of the concrete frame being cast in place. The reasons for casting some parts in place were; (1) irregularity of form; (2) reinforced concrete floors cast integrally with frame and (3) beams too heavy to allow placing with the available lifting equipment.

Fig. 8 shows some of the formwork for a portion of the building which was cast in place, and Fig. 9 part of the storage area where precasting was used. A comparison of these two figures may be a clear enough indication of the saving of labour and form lumber by precasting. Note also the excellent appearance of the unfinished concrete columns. The concrete for these was placed with a slump of about 1½ in. Fig. 10 shows a part of the storage area in the finished building. The centre bay is 60 ft. wide and side bays 30 ft. and 50 ft. wide. The roof over this area is carried by light steel trusses of the Dominion Bridge type.

The cost of a structural frame compared to the total cost of a building varies according to the class of such a building. For that reason it is not possible to state specifically the percentage of saving that may be expected, if precast construction is substituted for cast-in-place or steel frame design. A recent experience, however, indicates the possibilities. A month or so ago this firm called for tenders on a fairly large building, combining warehouse area, mechanical shops and a considerable amount of office space. In this instance about sixty per cent of the high frame was to be precast concrete, and the balance cast-in-place concrete. Six bids were received. Four of these tendered on our plans and specifications while the fifth stated that he would use cast-in-place concrete entirely. The sixth contractor proposed to use a structural steel frame. It is rather significant that these bids were 11 per cent and 6 per cent respectively, higher than the average of the first four tenders. This result seems quite satisfactory in view of the limited use of precasting adopted for this building.

One of the greatest drawbacks at the present time for more extensive use of heavy precast members is unavailability of suitable lifting equipment. Industrial buildings often require long spans, where reinforced concrete precast beams would be too heavy for lifting with the available machinery. As the economy of precasting becomes better known, and the construction technique more often used, it may be expected that stronger lifting equipment will be more readily available. *(Continued on page 490)*

Fig. 9. Bus Depot. Columns have been erected and beams are being concreted. Note absence of form work as compared to Fig. 8.

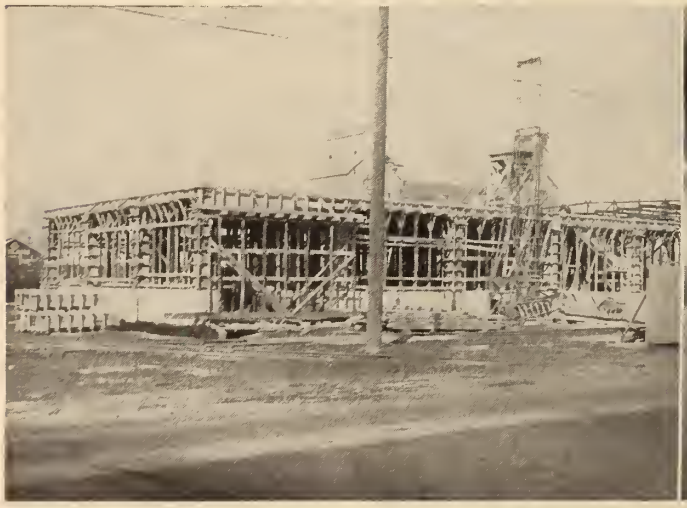

Fig. 8. Bus Depot. Office wing of building showing formwork for cast-in-place concrete.

Fig. 10. Bus Depot. Storage area in finished building.

Maintenance Testing of Electrical Apparatus

A paper presented before the Electrical Section, Winnipeg Branch, The Engineering Institute of Canada, on November 8th, 1951.

by

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The modern maintenance engineer might be likened to a medical doctor, in that he keeps a constant check on the operating apparatus of the system, in an effort to detect any points of possible failure, and cure them. Upon the success of his undertakings might well depend a human life. Certainly, the success of maintenance testing of electrical apparatus for weakness depends on the maintenance engineer and the testing technique and equipment he uses.

This discussion is an introduction to the use of a-c dielectric loss and power factor insulation tests for preventative maintenance of electrical apparatus, as used by Doble Engineering. For convenience, the term, "Power Factor Insulation Test", is used to refer to the complete a-c dielectric loss test. It is being used for the routine maintenance testing of various types of electrical apparatus, such as bushings, cables, capacitors, circuit-breakers, generators, insulators, voltage regulators and transformers, etc.

Types of Insulation Tests

The more common types of electrical insulation tests may be classed as *destructive* (primarily for factory use), such as 60-cycle High Potential, Kenotron, and Impulse; and *non-destructive* (for maintenance tests), such as A-c dielectric loss and power factor, and D-c insulation resistance and dielectric absorption.

The effects of repeated destructive tests on insulation are cumulative. These tests are not normally used for field maintenance, except for special investigations after preliminary non-destructive tests have been made.

The basic principle of non-destructive tests is the detection of a change in the measurable characteristics of an insulation which can be associated with the effect of moisture, heat, ionization (corona), lightning, and other destructive agents which reduce the breakdown strength of insulation. The measurable characteristics of an insulation are affected by temperature and, in the case of d-c tests, by the duration of the test. It is essential that all test data be compensated for these normal variations. Data are available for compensating for changes in the dielectric loss with temperature for most of the common insulations.

Characteristics of Insulation

The characteristics of an insulation that are commonly measured in non-destructive testing are:

(1) A-c dielectric loss, which may consist of the following components; (a) dielectric absorption, (b) conductivity (volumetric and surface), or (c) ionization (corona).
(2) Capacitance.
(3) Power factor.
(4) A-c resistance.
(5) Presence of ionization.
(6) D-c insulation resistance.
(7) D-c dielectric absorption.

Dielectric Loss

All commercial solid and liquid insulations have some measurable dielectric loss at normal operating voltage and frequency, since the term "non-conductor" is but a relative one. However, these losses are usually small, and vary approximately as the square of the applied voltage. An appreciable increase in the normal dielectric loss is one of the first indications of deterioration and operating hazards.

Gaseous insulations such as air do not have a measurable loss until they become overstressed and ionized. Solid insulation, unless thoroughly impregnated or immersed in liquid insulation, usually has voids containing air. If these voids become overstressed and ionized during the application of a test voltage, the resulting dielectric losses in the voids will be added to those in the solid insulation. The losses will therefore increase at some higher power than the square of the voltage. The presence of voids that become ionized at normal line to neutral operating voltage may cause carbonization or radio interference. For this reason apparatus insulation designers try to eliminate voids wherever feasible.

The dielectric losses of most insulations increase as the temperature of the insulation increases. In some cases insulations have failed, due to the cumulative effect of temperature. For example, a rise in temperature

Mr. Smith's paper deals with preventive maintenance testing for various types of electrical apparatus, such as bushings, cables, capacitors, circuit breakers, generators, insulators, regulators and transformers. It should be of wide interest for electrical operating and maintenance engineers, particularly those of the larger power companies, who are continually checking their equipment. The paper is in two sections: the first a review of dielectric principles, and the second dealing with the application of tests.

causes a rise in dielectric loss, which in turn causes a further rise in temperature.

The earlier cable insulations had a relatively large dielectric loss which increased rapidly with temperature. However, modern paper-insulated cable has a very low dielectric loss which is not appreciably affected by rise in the cable temperature.

It is not necessary to have a direct metallic connection in order to measure a-c dielectric losses in an insulation, but merely a capacitance coupling with the source of test voltage and measuring device. Extraneous insulation may cause losses which will be measured by the test equipment, unless means are taken to shield out the extraneous insulation. This phenomenon makes it possible to detect deterioration in insulations not directly coupled to the energized conductors; for example, wood angle braces in a breaker.

Capacitance

The elementary principles of an electrical condenser or capacitor are generally known. However, a few of the principles are reviewed here because the behaviour of an insulation in service can be more easily understood when the insulation is considered as the dielectric of a condenser. The energized conductors may be considered to form one plate and the grounded apparatus frame the other plate of the hypothetical condenser.

Some of the characteristics of an electrostatic or dielectric field also are of interest in connection with testing of insulation. The strength of a magnetic field is a function of current, whereas the strength of a dielectric field is a function of voltage. The lines of magnetic flux around a conductor take the form of concentric circles, whereas the lines of dielectric flux around a conductor are radial. Both electro-magnetic and electro-static fields are required in order to transmit power.

The dielectric constant (SIC or K) of an insulation is an indication of the ability of the insulation to pass dielectric flux through it, with air a standard of comparison. An insulation having a high dielectric constant will pass more dielectric flux than an insulation having a low dielectric constant, under the same electrical conditions. The dielectric constant of some of the more common insulations, together with their power factors, are listed later.

In order to maintain an a-c voltage and a dielectric field through an insulation or between the plates of a condenser, it is necessary for a charging current to flow. The charging current of an insulation is somewhat analogous to the magnetic excitation current of a transformer. The amount of charging current taken by a given condenser or insulation is a function of the impressed voltage and frequency, and the capacitance of the condenser or assembled insulation. The capacitance of a condenser depends upon the area of the condenser plates, the spacing between the plates and the dielectric constant of the dielectric medium (insulation) between the plates.

The voltage drop through a series of condensers varies inversely as the capacitance of the individual condensers. The capacitance of a condenser is a function of the dielectric constant of the dielectric medium. Consequently, designers of electrical apparatus select, where possible insulation with dielectric constants which give the desired voltage distribution through the sections of insulation. Alternatively, they change the dimensions of the plates of the condensers, for the same purpose as in the case of the well-known condenser bushing. The dielectric constants of most commercial insulations range from 2.0 to 7.0. However, the dielectric constant of water is 81. Hence, when an insulation becomes wet, it is apparent that the capacitance is increased as well as its dielectric loss.

Changes in the normal capacitance of an insulation indicate to the test engineer such abnormal conditions as the presence of moisture, short-circuited condenser sections in a bushing, or breaks in the ground shields of bushings. The capacitance of a dry insulation is not appreciably affected by an increase in temperature. In the case of wet insulation, however, there is a tendency for the apparent capacitance to increase with temperature.

The charging current of an air condenser which normally has no losses, is a pure capacitance current leading the impressed voltage by ninety degrees. The charging current (I_z) of commercial insulation, which has some loss, is the resultant of the capacitance component (I_c) and energy component (I_r). However, for good insulation I_c and I_x are of substantially the same magnitude, since the energy component is very small. The approximate capacitance of a condenser may be computed from its charging current at a given voltage and frequency.

Power Factor

The power factor of an insulation is the cosine of the angle between the charging current vector and the impressed voltage vector. In other words, it is a measure of the energy component of the charging current. The amount of charging volt-amperes and the dielectric loss in watts, at a given voltage, increase with the amount of insulation being tested. However, the ratio (power factor) between the charging volt-amperes and watts-loss remains the same regardless of the amount of insulation tested, assuming that the insulation is of a uniform quality. This basic relation eliminates the effect of the size of electrical apparatus in establishing "normal" insulation values and thus simplifies the problem for the test engineer. The Doble power factor insulation test equipment measures the charging current and watts-loss from which the power factor, capacitance and a-c resistance can be easily computed at a given test voltage.

The 60-cycle power factor and dielectric constant (SIC) of a few typical insulating materials, also for water and ice, are approximately as follows:

	% P.F. @ 20°C	SIC
Air	0	1.0
Oil	0.1	2.1
Paper	0.5	2.0
Porcelain	2.0	7.0
Rubber	4.0	3.6
Varnished Cambric	4.0 - 8.0	4.5
Water	100.0	81.0
Ice	1.0 (Est)	86.4

Note: Ice has a volumetric resistivity of approximately 144 times that of water. This illustrates why tests for the presence of moisture in an insulation should not be made at freezing temperatures.

The normal power factors of assembled apparatus insulation are approximately as follows:

	% P.F. @ 20°C
Bushings (condenser & oil-filled)	1.0
Bushings (compound-filled)	2.5
Transformers (oil-filled)	1.0 - 2.0
Cables, paper-insulated	0.3
Cables, varnished-cambric insulated	4.0 - 8.0
Cables, rubber insulated	4.0 - 5.0

Dielectric Absorption

The exact cause of the phenomenon of dielectric absorption is not fully understood by scientists; however, the effect of this phenomenon is well-known. When a d-c insulation resistance test is first applied to a transformer or generator, the initial resistance is low, and gradually increases as the duration of the test is lengthened. It takes energy to establish an electrostatic field in an insulation. Once the field has been fully established, however, the charging current drops down to a

value which is a function of the continuous leakage through the insulation. The energy required to "charge" an insulation is usually referred to as the dielectric absorption loss. The losses from dielectric absorption may be on the order of one hundred times the losses from continuous leakage through an insulation.

When an alternating current is applied to an insulation the effect of the phenomenon of dielectric absorption greatly predominates over that of leakage or conductivity. This is because the dielectric field never becomes fully established with one polarity before the alternating charging current is reversed and starts to build up with the opposite polarity. For all practical purposes this makes constant frequency alternating-current measurements of dielectric-absorption loss independent of the duration of the test potential, provided the insulation has not reached an unstable position with respect to temperature effects.

Dielectric-absorption losses are sensitive to small changes in the moisture content of an insulation and to the presence of other impurities; i.e. For example, a small amount of moisture will cause a large increase in dielectric absorption. The fact that a-c dielectric losses are due almost entirely to the phenomenon of dielectric absorption makes the a-c dielectric loss and power factor test a very sensitive test for moisture.

Conductivity

Practically all insulators are conductors of electricity to some extent. It appears more logical therefore, to use the term conductivity than resistivity in discussing this component of insulation losses. The conductivity or leakage of an insulation may be considered as the reciprocal of its volumetric and surface resistivity. The final resistance value obtained from a d-c insulation resistance test is a measure of the continuous conductivity of the insulation.

In cases where an insulation consists of several layers or laminations, it is possible to obtain an erroneous indication of the breakdown strength of an insulation with d-c insulation resistance tests. For example, if there is a layer of high resistance insulation in series with one having a low resistance, the overall d-c insulation resistance will be largely determined by the high resistance layer.

In effect, a layer of good insulation interrupts the d-c test circuit, except during the initial transient charging stage. A high resistance layer of insulation is frequently found in series with a low resistance layer of insulation in the service deterioration of electrical apparatus insulation. This is one of the chief reasons for the development of the a-c dielectric loss and power factor test. The a-c test is not hindered by a "good" layer of insulation in series with a layer of "bad" insulation. Alternating current merely requires a capacitance coupling to pass charging current and permit the measurement of the total dielectric loss of an insulation.

The "Hot-Collar" measurement is a good illustration of a capacitance coupling. By applying a-c potential to a metallic band wrapped around the outside of a porcelain bushing, with the bushing conductor grounded, losses resulting from damp or carbonized insulation contained within the porcelain can be measured. This cannot be done with commercial d-c insulation test equipment.

The d-c test does, however, have an advantage over an a-c test in those cases where it is desired to separate the conductivity losses from the dielectric absorption losses; for example, to more easily detect a localized fault where there is a continuous conducting path to ground. However, a large majority of the cases of deteriorated insulation, as found in the maintenance of electrical apparatus, involves discontinuous paths to ground and requires an a-c test to locate.

In general, the d-c test is largely a measurement of surface resistivity unless a complete dielectric absorption test (resistance-time) is made. On the other hand, the a-c test provides a measurement of surface and volumetric resistivity, dielectric absorption, and the presence of ionization. The d-c dielectric-absorption tests, however, promise to be a useful tool in maintenance testing technique, especially for large apparatus such as generators.

A-C Resistance

Dielectric loss may be expressed in terms of a-c resistance by dividing the square of the test voltage by the watts loss. The insulation quality of sections of wood members, such as lift rods, may be judged more easily and more comprehensively in terms of a-c resistance per unit length than in terms of power factor. This is because of the variation in capacitance during tests. Any section of a wood member may be easily tested in place by the application of three electrodes. The two outer electrodes are usually grounded and the middle electrode is energized. D-c tests on wood members are almost entirely confined to a measurement of surface leakage.

Ionization

It has been pointed out that the solid losses (dielectric absorption and conductivity) of an insulation vary approximately as the square of the impressed voltage. Furthermore, if ionization losses are also present, the total dielectric loss will therefore vary at some higher power than the square. This phenomenon makes it possible to detect the presence of ionization within the range of the test equipment by plotting the power factor against the test voltage.

If there is no ionization present, the power factor will remain constant with increase in voltage. However, when ionization starts the power factor will increase with the test voltage. The ionization or corona point can therefore be detected by the shape of the power-factor test voltage curve. It is also possible to separate the solid losses from the ionization losses by a simple calculation. This is based on the assumption that the solid losses vary as the square of the voltage, and that the remainder of the total dielectric loss is due to ionization.

The ionization point of a gas is a function of the nature of the gas, the temperature and pressure of the gas, and the unit voltage stress on the gas. When a gas becomes sufficiently ionized or conducting, it may result in a sudden breakdown. Alternately, there may be a preliminary visual (corona) discharge, depending upon the shape of the electrodes.

It is not generally realized that the ionization or corona discharge may occur in electrical insulation at relatively low impressed voltages. It is apparent, however, that breakdown is a function of unit stress rather than total voltage. The strength of air films at atmospheric pressure is approximately as follows:

Thickness of Air Film in Mils	Breakdown in Volts per Mil
400	50
50	70
10	110
5	170
1	400

Many of the older forms of electrical apparatus operating on 13.2 kv. circuits were designed without much attention to the suppression of ionization at operating voltage. It is therefore of considerable value to the test engineer

to be able to detect the presence of ionization during routine maintenance tests. A frequent cause of ionization in the dry-type porcelain bushing is eccentricity of the conductor within the porcelain tube. Technique is available for correcting many forms of ionization in the older types of bushings.

Ionization frequently causes radio interference, and in the presence of moisture may cause destructive corrosion of metal parts which in turn causes further radio interference. Deterioration from corona is a frequent cause of insulation failures in generators rated 6.6 kv. and above.

Advantages of Power-Factor Tests

The power-factor insulation test is effective in locating operating hazards in electrical power apparatus, before failure, because it has the following advantages:

(1) It can detect the presence of "bad" insulation even though there may be a layer of "good" insulation in series with the "bad" insulation; d-c tests usually show "infinity" under this condition. Many forms of insulation deterioration involve layers of "good" and "bad" insulation in series. For example, sections of the insulation of a compound-embedded bushing, which have been unevenly exposed to moisture entering through the gaskets or a crack in the watershed.

(2) It provides a measure of the overall operating condition of the insulation in terms of a ratio (the power factor of the insulation) which is independent of the amount of insulation being tested. For example, oil-immersed, paper-insulated power transformers, in good condition, will have a power factor less than 2.0 per cent at 20 deg. C. regardless of make, size and voltage. The power factor of an insulation increases when the insulation becomes deteriorated. Experience has shown the abnormal power-factor values which indicate failure hazards.

(3) It provides a measure of the overall condition of a-c apparatus insulation under simulated normal frequency operating conditions, which is independent of the duration of the test. Direct current tests require more time, do not simulate normal insulation operating conditions, except for d-c apparatus, and the results are affected by the duration of the tests.

(4) It provides data for a comprehensive analysis of the nature of insulation deterioration and operating hazards, in terms of dielectric watts loss and charging current, at selected test voltages. From this data, power factor, capacitance, a-c resistance, and the presence of ionization (corona) can be determined. All of these measurable characteristics of insulation are used in the routine analysis of field test data.

(5) It provides data which permits an orderly grading of the serviceability of apparatus insulation, by comparison with the correlated results of many thousands of tests and investigations made on similar apparatus insulation, since 1929.

(6) It provides a more comprehensive picture of the overall operating condition of an insulation than any other single type of test.

Status of Power-Factor Tests

Power-factor insulation tests were first used on this continent about 1917 by cable manufacturers, for research and control of manufacturing operations. Power-factor tests were first applied to the field testing of apparatus insulation about 1929 by the Doble Company.

The three large manufacturers of bushings make routine power-factor tests on new bushings at their factories. Bushing manufacturers' literature recommends periodic field power-factor tests and contains typical power-factor data. One of the large manufacturers of transformers makes routine factory power-factor insulation tests on new power transformers rated above 2,500 k.v.a. and on all oil-immersed instrument transformers. All of the large transformer manufacturers are prepared to make power-factor insulation tests at their factories, and are familiar with the advantages of these tests.

Power factor tests on generator and cable insulation are still in the experimental stage. However, considerable progress has been made along this line. One of the large manufacturers of lightning arresters recommends the routine field use of a-c dielectric loss tests, to detect presence of moisture and corrosion in arresters. Field power factor tests on oil are made to detect the presence of such contaminants as moisture, oxidation products, and asphaltic compounds.

Test Procedure

Power-factor insulation tests on electrical power apparatus are made with the apparatus out of service. In many cases, it is necessary merely to open the disconnect switches to prepare the apparatus for the initial tests. A few tests made by applying an a-c voltage to the conductors of the apparatus in its assembled position and measuring the dielectric losses to ground, will indicate whether or not the insulation is in a normal condition.

If the initial tests indicate an abnormal condition, the test engineer has a number of special tests which may be applied to localize the deterioration. For example, he may apply hot-guard tests, hot-collar tests, cross check tests, oil tests, a-c resistance tests on wood members, etc. The hot-guard test is used for an overall insulation test on a transformer bushing of the draw-lead type, without lowering the oil to disconnect the bushing from the transformer winding. Collar tests are often used for testing transformer bushings having a solid conductor, without disconnecting the transformer winding.

The hot-collar test is unique in that it makes possible the detection of moisture and other forms of deterioration in a section of a bushing or pothead, without disturbing the main connections. This is done by applying a collar-shaped electrode over the section of the bushing to be investigated and applying an a-c test potential between the electrode and the bushing conductor. The dielectric losses in the bushing insulation under the collar can then be measured in the usual manner.

In the application of an overall insulation test, the ability to detect localized faults diminishes as the amount of insulation under test is increased. It is therefore desirable to isolate the apparatus under test, as far as feasible, from other connected apparatus. This may not be necessary for the initial tests in cases where but a single disconnect and a short section of copper are connected to a bushing under test. Additional examples of cases where tests can be made on apparatus without removing connections are bus and disconnect insulators, potheads, and transformer bushings. All of these can be tested in place by the hot-collar method.

(Continued on page 490)

THE PROBLEMS OF STRUCTURE AND OF ORGANIZATION IN RELATION TO ADMINISTRATION AND MANAGEMENT

by

Lyn Urwick

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About 130 years ago a book appeared which revolutionized all subsequent thinking on war. In this famous work, Von Clausewitz, distinguished between strategy and tactics. "The art of war," he writes, "divides itself into tactics and strategy. The former occupies itself with the form of the separate combat, the latter with its uses." In other words, tactics deals with how to fight, strategy with why, where and when to fight.

He goes on to discuss the value of such distinctions. "No doubt there will be many readers who will consider superfluous this careful separation of two things lying so close together as tactics and strategy, because it has no effect on the conduct itself of war. We admit certainly it would be pedantry to look for direct effects at the field of battle from a theoretical distinction. But the first business of every theory is to clear up conceptions and ideas which have been jumbled together and, we may say, entangled and confused: and only when a right understanding has been established as to names and conceptions, can we hope to progress with clearness and facility".

Seventy years later, the work of a famous American engineer, Frederick Winslow Taylor, first suggested a possibility that the task of managing a business, indeed of administering any form of organized human co-operation whatever its purpose, might similarly become "an intelligent occupation". That is to say, it could be regarded as an activity conducted not as a mere craft, learned, as it had hitherto been learned, only by imitation, trial or from the limited experience of the individual and the accidental series of events which life brought within the narrow range of personal observation, but as an activity which could become an art. An organized body of knowledge could be built up, infinitely wider than any individual's experience, a body of knowledge which could be transmitted to future generations systematically and in the order which would prove to be most suitable for the learning process. In short, there could be a theory of management, as Von Clausewitz had shown that there could be a theory of war.

A paper delivered in Toronto, Ont., October 11, 1951, before a joint meeting of the American Society of Mechanical Engineers, the Chemical Institute of Canada, and The Engineering Institute of Canada.

That conception has been struggling to make headway against exactly the difficulties which Von Clausewitz anticipated, the objections of "practical" men who have themselves received no formal training, that theory is useless because they can find in it no direct benefit in dealing with the immediate problems which face the business administrator.

And Von Clausewitz's further comments are so pertinent to our subject of enquiry that they are worth remembering. "Tactics and strategy," he continues, "are two activities mutually permeating each other in time and space, at the same time essentially different activities, the inner laws and mutual relations of which cannot be intelligible at all to the mind until a clear conception of the nature of each activity is established.

He to whom all this is nothing, must either repudiate all theoretical consideration, or his understanding has not as yet been pained by the confused and perplexing ideas resting on no fixed point of view, leading to no satisfactory result, sometimes dull, sometimes fantastic, sometimes floating in vague generalities, which we are often obliged to hear and read on the conduct of war, owing to the spirit of scientific investigation having hitherto been little directed to those subjects."

The task is to discuss one particular aspect of the art of administration, that aspect which is usually described as organization. And, if we substitute "the organization of business" for "the conduct of war", Von Clausewitz's sentences just quoted are an exact description of much present talk and writing on the subject.

Moreover, just as no theory of war is possible without a clear distinction between strategy and tactics, so no theory of organization is possible without a similar distinction. One division is the dynamics of administration. It is concerned with all those problems in the conduct of undertakings in which consideration of the individual human being is inevitable, if not of paramount importance. The other is the mechanics of administration which deals with all those

problems in the conduct of an undertaking which can be considered in the abstract without reference to the idiosyncrasies of any individual. They can and should be treated as divorced from personalities. To be sure, they demand certain generalizations about human nature. Those who are inclined to question the possibility of such generalizations or their utility, because the subject of management is, comparatively speaking, a new one, should recollect that the whole structure of economic enquiry has been erected on a similar foundation.

Henri Fayol, the famous French industrialist, analyzed administration into six parts or aspects; forecasting, planning, organization, command, co-ordination and control. It is clear that forecasting and planning belong to the mechanics of administration. If you are trying to measure the potential market for a product, you will ask yourself what all the Mrs. Smiths will do, but you do not ask yourself, except as a unit enquiry building up the larger investigation later, what a particular Mrs. Smith will do. The idiosyncrasies of the individual are irrelevant.

Similarly, in planning any productive process you make the assumption that, on the average, the individual worker will produce the same quantity of units in any given operation. Indeed, standardization, the setting of norms or targets or budgets to which it is anticipated actual performance will approximate, is one of the most potent instruments in the armoury of the scientific production engineer.

Equally, it is obvious that command, co-ordination and control are aspects of administration in which it is not only impossible but suicidal to ignore the individual. In the words of Great Britain's most distinguished living psychologist:

> "We can deal with human beings fairly and efficiently only by making an intensive, individual study of each isolated mind; there is no other way. Human personality, with all its infinite variety, is the most important single factor in all our social life; and the expenditure of time, however lavish, will never be lost."

The difficulty of distinguishing between the dynamics and the mechanics of the subject always arises in trying to think clearly about organization. Nor is this surprising. For the reason just given in discussing command, co-ordination and control, the successful administrator spends much of his working life dealing with personal issues.

Without a constant sensitivity to what is going on below the surface, a sensitivity which can be improved and refined by theory, but which is ultimately dependent on an instinctive grasp of how other individuals react to him and to each other, the administrator is not likely to get far. Tact and judgment are the keys to effective leadership. Successful practical men rightly devote much of their lives to exercising them. Equally rightly, they highly value this quality in themselves. They are impatient with, if not contemptuous of, efforts to push intellectual processes beyond effective limits. They know that all the logic in the world, an irrefutable array of facts and arguments, is worth less than nothing if the sentiments of those they lead leave no chink for the light of reason to enter.

Even Fayol himself fell into this "practical man" fallacy of treating organization as if it included consideration of individual personalities. He wrote:

> "If we could eliminate the human factor, it would be easy enough to build up an organization; anyone could do it if they had some idea of current practice and had the necessary capital. But we cannot build up an effective organization simply by dividing men into groups and giving them functions; we must know how to adopt the organization to the requirements of the case, and how to find the necessary men and put each one in the place where he can be of most service; we need, in fact, many substantial qualities."

With due deference to a man who was both a great theorist about, and a most distinguished practitioner of, the art of administration, his inclusion of the phrase "how to find the necessary men and put each one in the place where he can be of most service", under the heading "Organization" is a mistake in analysis and classification. To find and to assign people to posts are activities known in the jargon of management as "selection and placement". They are part of staffing or manning, what is known in the British Civil Service as "establishment work" or, often in management studies, as "employment", a subdivision of "personnel work". And this is quite clearly a part of that aspect of administration which Fayol calls Command.

If this view be accepted, it is possible to draw the distinction between the dynamics and the mechanics of administration quite clearly. Organization can be defined objectively and without reference to persons as individuals. The process of organizing consists of "determining what activities are necessary to any purpose and arranging them in groups which may be assigned to individuals." Such a group of activities we describe as a "position" or "post". The organization is the structure, the plan if you like, of positions or posts, each with its assigned activities and its relationships with other positions or posts. When an individual is assigned to a post the activities included in it become his "duties", i.e., "the activities which he is required to perform by virtue of his membership in the system of co-operation". His relationships with other positions or posts will usually be in terms of "authority", "the formal right to require action of others", and "responsibility", which is "accountability for the performance of duties".

This view of organization turns it into a purely intellectual process, a designing, a drawing-office job. But it does not, as Fayol suggests, rob organization of its own importance. Taking his own words, it involves "knowing how to adapt the organization to the requirements of the case". And that, again in his own words, requires "many substantial qualities". It needs experience and a nice discrimination. It is primarily a drawing-office job, but it is the kind of designing which can be done only by someone who knows intimately the particular system of co-operation, its objectives and policies and resources, and has a wide knowledge of the alternative forms in which activities can be grouped.

It has, moreover, two major advantages. By putting organization among the aspects of administration which are primarily intellectual, it definitely draws the line of demarcation between the mechanics and the dynamics of the subject. Organization belongs to the mechanics with forecasting and planning; command, co-ordination and control belong to the dynamics. That is not to imply that there are no mechanistic elements in these aspects of the subject. A growing awareness of the methodology of management has enabled us to develop an increasing range of useful techniques, but they

are techniques which must be applied with a constant sensitivity to the human factor, incessant watchfulness for individual reactions and a consciousness of the limitations of exact knowledge in this field. Here the administrator forgets at his peril that the first syllable of management is man, "homo", so arrogantly and so mistakenly classified as "sapiens".

By segregating organization in this way, by isolating it from consideration of the individual, we are enabled to begin the task of building up and arranging a definite theory of the subject, a technology of the task of organizing. This technology can be of great value to the practical administrator. In Von Clausewitz's words, we are able "to clear up conceptions and ideas which have been jumbled together, and, we may say, entangled and confused".

But, as has been already pointed out, the practical administrator, and even some of his theoretical brethren, are extremely reluctant to admit either the possibility or the utility of such a body of knowledge. As the historian of the British Army Staff College wrote of the average regimental officer in the 1860's, fifty years after the Staff College had been founded, "He was, as he always had been, the finest in the world. All he needed was that boldness should be reinforced by knowledge, to appreciate that fighting can be an intelligent occupation. But his appetite for education was extremely delicate. He thought it damned rot". A couple of years ago this general thesis was attacked with almost emotional fervour in an American periodical devoted to public administration by a professor of political science. It was represented as hard-boiled and inhuman and he amused himself for a couple of pages in restoring man to his rightful position as the centre and purpose of all organization. In truth it is neither hard-boiled nor inhuman.

It is therefore worth while to point out some quite practical reasons why we should consider the structure or organization first and the selection of individuals to fill the positions thus created second and separately. In the first place, in really large undertakings we cannot and never have done anything else, though we may not have been very clear as to why we adopted particular forms of organization. In the army, for instance, it is inconceivable that we should start with Major Buggins, and after studying his personal peculiarities and the eccentricities of his individual experience, set up an organization to suit him. We start with organizations, with the concept of a battalion which needs someone as its second-in-command, a post involving certain defined duties and responsibilities. If Buggins can satisfy those requirements, well and good, he is put into the post. But the fact that he can also play the ukulele, doesn't tempt the authorities to add to the duties of the post those of modernizing the music of the regimental band. If he can't satisfy the requirements of that post, and there is no other vacancy in the army establishment suitable for a person of Buggins' rank and qualifications, it's just too bad for Buggins. But no one thinks of inventing a special job for him.

In business, until within the recent past, that has been a rather common practice. Organization was built up around the personalities available. The consequences were frequently disastrous. The business corporation is by theory immortal, the individual is not. The principal of those responsible for a corporation should see to it that there is a constant succession of individuals coming forward to fill the different posts as they fall vacant. It is true that in a comparatively small corporation the incidence of vacancies is only occasional. But if the duties of a post are determined by the qualities and experience of an individual, there is no process known to man by which the problem of replacing that individual can be handled intelligently when the emergency arises.

It is impossible to conceive of a system of training adequate to prepare individuals to fill a variety of posts, the duties of which are not grouped logically or in accord with the knowledge developed by a recognized form of professional instruction, but are determined by the accidents of the background experience of the present incumbent. And if an attempt be made to dodge the difficulty by appointing understudies or deputies, some of the weaknesses due to lack of knowledge and identical experience are avoided, but an even worse dilemma of temperamental difference is often created.

Almost invariably the worst possible man to replace a powerful executive is a younger man who has been successful as his deputy over a reasonably long period, because what a powerful executive needs in his deputy are qualities complementary to and therefore different from his own. If the executive is aggressive, inclined to make quick decisions, he needs someone who is more cautious and careful in coming to an opinion and less obstinate. If the deputy be a replica of his chief, the chances that he will stay the course, as his deputy, are meagre.

Moreover, when a position falls vacant the ambitions of individuals within the undertaking are aroused. The chief executive has an awkward choice to make. He has to select among two or three individuals, all of whom have served him and the institution well, and give one of them greater responsibility with its concomitant advancement in status and remuneration. But if the duties of the post are clearly defined, if the organization has been set up in accordance with principles which everyone knows, he has only one choice to make. The reasons for his decision are obvious and the choice appears proper and rational to the general body of his colleagues, with the possible exception of those who feel that they have been passed over. And it is of great importance to a leader, especially in a democratic society, that his decisions should have this quality of appearing reasonable to a substantial majority of his colleagues.

If, on the other hand, every major change involves a reshuffling of duties and responsibilities of the higher posts, the chief executive is involved in a process which appears to his colleagues as chancy as dealing a pack of cards, less dependent on chance and more dependent on sleight of hand than on honest dealing. Where such a process occurs there is always the feeling that the thrusters, the men who are primarily interested in their own personal ambitions, who are "viewy", do better than their more valuable colleagues who think first of the team and its interests. Those engaged in what is known colloquially in the British Civil Service as "empire building" appear to the majority to have the more favourable chance.

The chief executive, however honest his intentions, has no answer. Instead of setting himself a single choice he has to solve an equation with a large number of variables. He may be perfectly right in the complex process of decisions which led him to give one-quarter of the duties of the vacant post to A, one-third to B, and the rest to C. But even if he can explain that process to himself, it is exceedingly improbable that he can explain it to the group, or that they will believe

him if he does. The chances are strongly in favour of their suspecting that there is some sinister element behind the result—nepotism, favouritism or the triumph of skilful personal politics. And they will draw their conclusions and probably act on them. Now there is nothing more calculated to make any group of people unhappy, frustrated and generally to lower their morale, than the conviction that in their little society, the opportunity to grow, which is an almost universal human need, is determined by toadying, favouritism and successful intrigue. They want to grow in the job and on the job, but in the open air, not up the backstairs or in the president's ante-chamber. As Lord Samuel once observed, "the worst chamber is better than the best ante-chamber".

Where organization is not put first and personalities second, it nearly always means that there is indefiniteness about the make-up of posts, that individuals are vague and uncertain as to what their duties, responsibilities and authority really are. Use and want may have enabled them to arrive at a workable mutual understanding, but more often than not this is not so. The amount of personal friction, backbiting and positive cruelty in life is enormous, and a large proportion of them centre around disputes which are wholly unnecessary as to competence, authority and status. A little clarity by higher authority as to organization would blow them away. Men are entitled to know what is expected of them.

Time after time an individual has been labelled as difficult or quarrelsome or a bad member of a team. Generally, a little investigation has revealed that the distribution of duties and responsibility was so vague or so lacking that archangels would have fallen out.

It is because institutions exist for the sake of human beings, not the reverse, because "human personality with all its infinite variety is the most important single factor in all our social life", that we should put organization principles first and direct consideration of individuals and their varied characteristics second. That is the right order. And if we learn to do this, we shall provide a framework of government within which human societies, great and small, can give us or our successors an environment in which human beings collaborating can realize the highest of which they are capable. And that is a prospect to which we can set no bounds. √

PRECAST REINFORCED CONCRETE BUILDING FRAMES

(*Continued from page 482*)

It is also possible to cut the weight of precast members by using stronger mixtures. We know from experience that 5,000 pound concrete is easily obtained in precasting. It seems probable that the economic value of such high strength concrete is not yet fully appreciated for use in structures where the dead weight of member is a considerable part of the total load it has to carry.

A great reduction in dead weight of beam and, in addition, a greater load carrying capacity, may also be obtained by prestressing. It is difficult to state when this procedure becomes profitable. Even more than for ordinary precasting, this will depend on the number of beams to be manufactured and their span lengths. It is clear that the greatest relative economy will be reached where ordinary precast beams get too heavy for efficient handling. Just at what length of span this occurs is difficult to say. Ordinary precast beams get rather heavy for spans longer than forty feet, so perhaps the boundary line of economy of prestressing lies somewhere near this figure.

Precasting is not specifically a European method, and was probably started as early in America as in Europe. It is true, however, that at present the method is used to a much larger extent in Europe than here. It has often been said as an excuse for using very massive sections, that labour is cheap in Europe and material more expensive compared to North America. Refinement of design was, therefore, less justified here. This reasoning certainly does not apply to precasting, where the principal saving is in labour. The superior North American economy is largely due to mass production and the use of labour saving methods. Precasting is merely a means of applying these principles to building construction. Even the saving of material, and especially of steel, is now of much greater importance than before the last war.

In closing it should be stated that precasting cannot be expected to replace ordinary cast-in-place construction. This method of construction is only suitable and economical for special conditions but may, in such cases, result in large savings in time and money. √

MAINTENANCE TESTING OF ELECTRICAL APPARATUS

(*Continued from page 486*)

Interpretation of Test Data

The interpretation of insulation test data involves the use of elementary principles in the dielectric behaviour of insulating materials. It also requires the use of correlated test data acquired by experience since about 1929.

Tables for grading the serviceability of insulation will be found in the Doble Instruction Book. In many cases failure hazards of apparatus insulation are expressed in terms of maximum allowable power-factor values. Changes in the "normal" watts loss, a-c resistance and capacitance are also used for indicating hazards in apparatus insulation, depending upon the type of insulation being investigated.

The "normal" test values for various types of apparatus insulation have been obtained by testing thousands of similar pieces of apparatus in the field and in the factory. The "Remove" test values have been obtained from a correlation of known test values at which apparatus insulation has failed in service. These data have been supplemented by many investigations, in the field and in the laboratory, of apparatus having abnormal test values.

Frequently the abnormal test values obtained during the initial tests are due to accumulations of carbon deposit or bad oil, which may be cleaned up without permanent injury to the main insulations. These conditions may represent serious operating hazards which require immediate attention. The ability of the test to detect this type of operating hazard before a visual inspection is made of the interior of the apparatus, facilitates a more efficient use of maintenance manpower and savings in maintenance costs.

Apparatus with deteriorated insulation may sometimes operate for a long time without a failure, depending upon its exposure to over-voltages and short circuits. Deteriorated insulation creates a definite operating hazard, however, which must be corrected if needless interruptions are to be eliminated. Deteriorated insulation, if removed before failure, may often be reconditioned and restored to service, with substantial savings in material costs. √

The Opposed-Piston Diesel Engine

by

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A paper presented at the semi-annual meeting of the American Society of Mechanical Engineers, Toronto, Canada, June 11-14, 1951, and presented also to the Buffalo Railway Club, September 13, 1951

The opposed-piston engine has been a star performer from the time of its first appearance in the "nineties" as a gas engine. It has established itself since the early part of the century as a marine oil engine. It played an important role in the United States Navy during the last war. In post-war years it has been widely adopted for railway and commercial uses.

In this paper the Author traces the history of its development and discusses its basic elements which make it the nearest approach to the ideal combustion engine. The design features of the locomotive type, now being manufactured in Canada, are described, as well as the construction and operation of the various mechanical parts.

In studying the general diesel motive power plant situation as it is today, we find that the modern diesel engines fall into two obvious classifications; that is, the two-cycle and the four-cycle basic types, with probably a slight advantage in favour of the two-cycle type of engine.

In further trying to subdivide the engines into classifications, we find that there has been considerable standardization of design and thinking over the past twenty years with one notable exception. The opposed-piston type of engine while operating basically on the two-cycle premise differs mechanically to such a degree from all other types of engines that it deserves special attention.

These differences, as we will see later, have made this type of engine an outstanding performer since the design was originated in 1892. These same differences give it the unique advantage of possessing much latent possibility when used in conjunction with an exhaust gas turbine. In the years to come it may well challenge the straight gas turbine as the ideal locomotive power plant.

With the introduction and manufacture of the two-cycle opposed-piston engine in Canada, it seems timely to discuss the design of the modern opposed-piston engine as it is today, its background and its past history. This paper will endeavour to explain some of the original engineering premises and will relate, as you will hear later, the story behind the late introduction of this type of engine into railroad services.

History of Opposed-Piston Design

Delving somewhat into ancient history, we find that in the year 1892, Wilhelm von Oechelhauser and Hugo Junkers, general manager and engineer, respectively, of the Experimental Station for Gas Engines, Dessau, Germany, patented and built a horizontal engine to operate on gas. As gas engines were becoming larger and more difficult to balance, these two engineers were early to recognize the natural inherent balance characteristics of the opposed-piston design. This engine had a bore of 200 m/m and a stroke of 500 m/m per piston. It developed 113 b.hp. at 160 r.p.m. This engine is now universally recognized as being the first opposed-piston engine embodying many of the mechanical features that are still in use today. It is shown diagrammatically in Figure 1.

Figure 2 shows a later design evolved by Oechelhauser in 1896. These engines were manufactured by Deutsche-Kraft-Gesellschaft as single cylinder units, and developed 300 hp. at 135 r.p.m. The bore was 480 m/m and stroke per piston was 800 m/m.

Following the introduction and satisfactory performance of the Oechelhauser opposed-piston design a considerable number of opposed-piston gas engines were introduced by various manufacturers in Britain and Europe.

In the year 1907, the first Junkers opposed-piston experimental oil engine was designed. It had a bore of 200 m/m and a stroke of 400 m/m per piston and operated at 200 r.p.m. Several years later, a much larger Junkers engine was constructed, rated at 1000 hp. It had two tandem cylinders and had a bore of 450 m/m and a stroke of 450 m/m per piston.

Professor Junkers resigned from the Technical University of Aix-la-Chapelle in 1912 and devoted his time to experimental research. Shortly thereafter, his laboratory was moved to Dessau. Professor Junkers' activity eventually placed him in control of the Junkers engine and the Junkers aeroplane factories.

During the early part of the twentieth century, the opposed-piston engine established itself firmly as a marine oil engine, mainly through the performance of the well known Doxford marine engine. The first experimental Doxford opposed-piston oil engine was designed in 1913. (Figure 3.) It was a single cylinder engine having a bore of 500 m/m and a stroke of 750 m/m per piston. The normal rating was 450 b.hp. at 130 r.p.m. and actually represented a prototype cylinder of a proposed four-cylinder marine engine.

It is interesting to note that a Doxford experimental engine built in 1914 was equipped with solid injection as an experimental step in the year 1919, and the injection system performed satisfactorily.

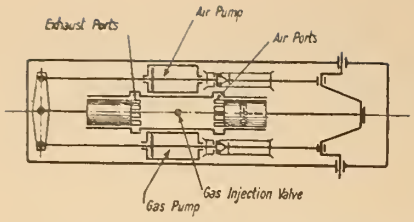


FIG. 1 OECHELHAUSER GAS ENGINE (1892)

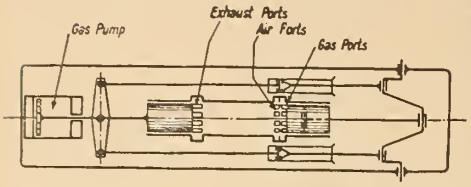


FIG. 2 OECHELHAUSER ENGINE (1896)

Considering the fact that direct injection was not universally accepted for fifteen or more years, this was a remarkable step at that early time.

Later Junkers developments included a 2000 b.hp liquid cooled. engine projected in 1939. This engine had four banks of six opposed-piston cylinders, and had a crankshaft rotation of 3000 r.p.m. It was reported that three engines of this type having an 80 m/m bore and a 120 m/m stroke had completed successful test-bed running.

At the end of World War II, a larger experimental engine having 105 m/m bore and 160 m/m stroke per piston was reported to be nearly completed. This engine was expected to develop 4500 b.hp., 4200 r.p.m., and was expected to weigh 1.32 lb. per hp.

Adaptation for Railway and Marine Use

In the year 1930, after intense study of engine types and configuration, the opposed-piston type of engine was selected by Fairbanks-Morse engineers as offering the most in regard to power output from the weight/horsepower ratio consideration, consistent with efficient and dependable railroad service. Such an undertaking was begun with full realization that it was to be a long-term development project and that above all else, reliability and efficiency were to be of prime importance.

After a year of engineering study and further design investigations, the first American-built opposed-piston high speed engine was produced. This was a 4 in. x 4 in. multi-cylinder engine and was followed almost immediately by a new design of engine having 5 in. bore, 6 in. stroke per piston, operating at 1200 r.p.m. This 5 in. x 6 in. engine was completed and tested in 1932. For the next three years the 5 in. x 6 in., 1200 r.p.m. engine was re-designed and re-tested, and at the end of the three-year period, the American opposed-piston engine was beginning to be commercially attractive.

The situation that arose because of the fitness of this engine to the locomotive application was rather unique. The very qualities that made the opposed-piston engine so satisfactory as a locomotive power plant also made it desirable for use in submarine and other naval applications. We find that this fitness in performance spotlighted this engine for its role in World War II. In seeking a reliable high output density engine for its submarine program, the Navy explored the possibilities of this engine and subjected it to exhaustive tests. Eventually, the United States Navy absorbed the entire output of this engine, so that its use for any locomotive application and commercial venture was entirely out of the question.

The arrival of World War II intensified demands for the engine with the result that it was diverted from railway and commercial service all during the war. It may be well to state that almost four million horsepower was installed in marine applications during the war years. It is hard to find a more convincing argument for the reliability of the design.

Advantages of the Opposed-Piston Design

We might consider briefly the many advantages that were apparent even to the very early developers of the internal combustion engine. In 1862, Beau de Rochas stated the following premises for efficient internal combustion engine design:

(a) Smallest possible cooling area for a given volume of combustion space;

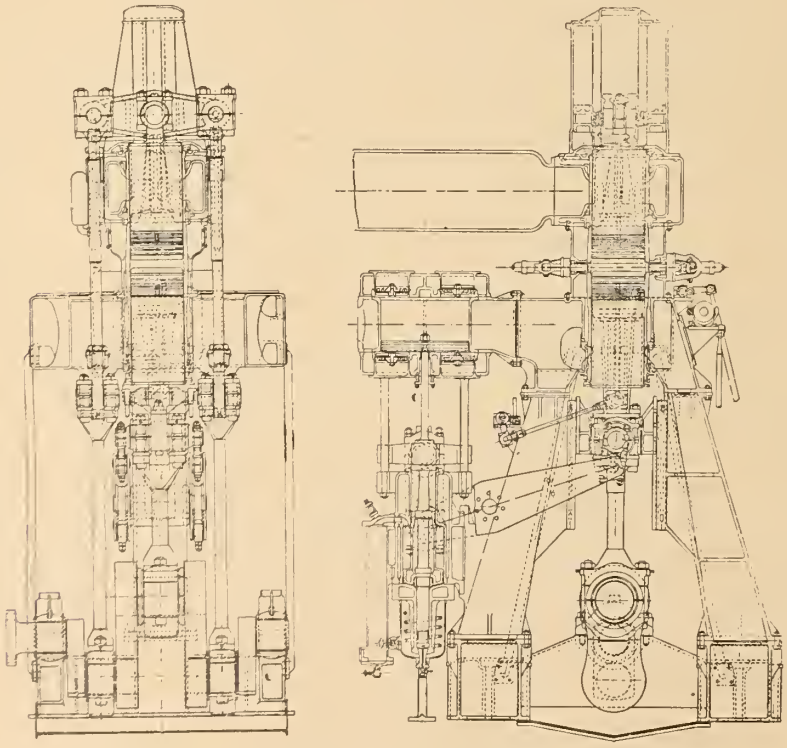
(b) Greatest possible rapidity of expansion (highest possible piston speed);

(c) Greatest possible expansion;

(d) Greatest possible pressure at the commencement of expansion.

Later, the theorists advanced the so-called "ideal diesel cycle". In it we have the rather impossible condition of perfectly insulated cylinders, pistons, and cylinder heads, with no heat losses to these parts. In other words, all of the combustion heat is put into the gaseous charge in the working cylinder.

We also have in the ideal engine an extremely high compression volume ratio and a very great expansion ratio. We now know after many years of experience that such an engine is impractical to say the least. Nevertheless, this ideal engine



DOXFORD ENGINE (1912-14)

FIG. 3

is exactly the type Dr. Diesel attempted to build in his first endeavour.

Over the past years, we have had to make many compromises in order to evolve a practical dependable diesel. We were forced to give up our thermodynamic ideals and apply effective cooling to the working pistons, liners and cylinder heads in order to prevent undue thermal distortion. We are also forced to provide reasonable conditions for the existence of the necessary lubricating oil film. The tremendous compression ratio had to be brought down considerably because of the impossible friction conditions that it brought about throughout the engine structure. For similar reasons, the high expansion ratio was avoided.

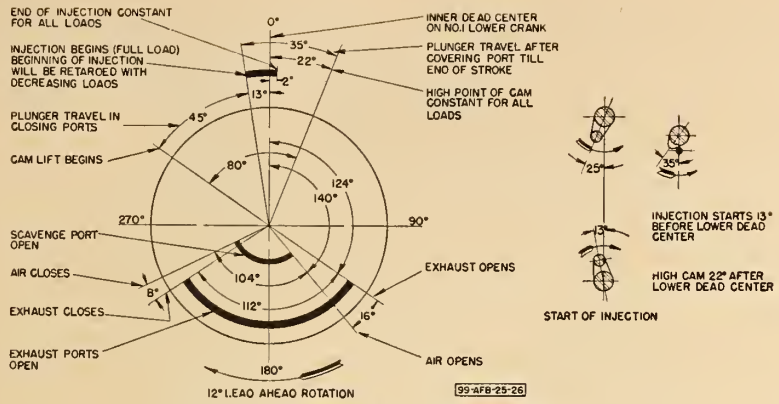


Fig. 4. Sequence and timing of events.

Almost the Ideal Engine

The basic elements of the ideal diesel engine have been reviewed briefly here with the express purpose of pointing out that the opposed-piston engine approaches more closely the ideal internal combustion engine than any other type. Since its combustion chamber is rather spherical in shape and is composed of two working pistons, the opposed-piston engine offers the minimum area for heat dissipation for a given cylinder volume. At the same time it further reduces combustion chamber heat losses by eliminating the water-cooled cylinder head function.

Along with the advantages of reduced heat dissipation to cooling water, the opposed-piston design offers the ultimate in uniflow scavenging, so desirable in efficient two-cycle high speed operation. With the constant trend toward higher piston speeds, the advantage of uniflow scavenging is becoming more apparent. At the conclusion of each expansion stroke the working cylinder must be swept clean of residual exhaust gases.

Along with the "straight-through" scavenging provided by the piston controlled port functioning, we have the fortunate combination that includes the necessary and, in this case, simple expedient of swirl control in the power cylinder. The swirl is produced by the tangential entry of the scavenging air through the especially proportioned intake ports.

This helical motion given to the scavenging air assists in sweeping clean the power cylinder of its residual products of combustion. As the exhaust ports are closed and the volume of air is trapped in readiness for the compression portion of the cycle, the swirl persists throughout the compression stroke. It is extremely effective in producing the efficient combustion so closely allied with the present opposed-piston engine.

There is one basic requirement of the diesel engine that is not always understood. In the usual gas or gasoline engine, we have the fuel-air mixture in more or less ideal proportions inducted into the cylinder, offering a more or less well mixed air fuel mass awaiting ignition at the proper time. In the diesel engine, we have the induction of air alone. We are faced with the problem of not only injecting the fuel at the proper time but also of injecting it in such

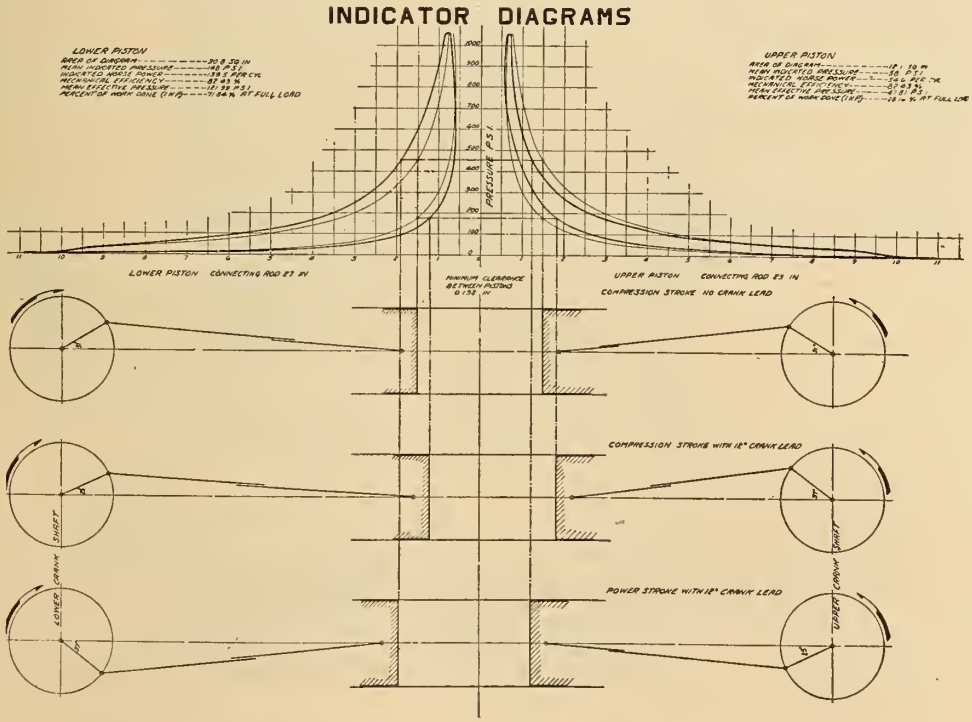


Fig. 5. Indicator diagrams.

a manner that it meets with sufficient oxygen to provide acceptable combustion.

In other words, were the fuel introduced into the cylinder in a rather bulky state we would have the condition whereby the cylinder contains all proper ingredients for a reasonably good combustion. However, the proper ingredients were not afforded the opportunity of becoming acquainted under the proper circumstance. Bearing in mind that the function of injection is not only to introduce the fuel into the cylinders but also to introduce it in such a manner that efficient combustion can proceed during the short time allowed, it is thus easy to see and recognize the importance of the swirl phenomenon in the combustion chamber.

Other advantages rather simply stated are the inherently fine balance characteristics of the opposed-piston design caused by the opposite movement of equal masses, along with the extreme mechanical simplicity and compactness of this design.

Design Features of the Locomotive Type

The high production demands made during the war contributed greatly to the design as we now know it. Because of the possibilities of depth bomb and torpedo damage, practically all castings were replaced by lighter forgings and steel stampings. All of these many small changes accomplished the objective in mind and at the same time made the engine more suitable for its present usage.

A good example of this revision and gradual evolution is the cylinder block. In its early form, it was a rather complicated casting. Then, for reasons stated above, it was redesigned into a weldment. The original welded cylinder block was composed of approximately 1000 single pieces of steel. This has since been reduced to a production cylinder block weldment made up of less than 300 component pieces.

During the reconversion period, the engine was re-adapted to both the railroad and commercial fields. It is now powering locomotives in units for all types of service ranging from 1000 to 2400 traction horsepower. It is also used commercially as a fully reversible marine propulsion engine, portable power plant engine and in municipal and industrial stationary applications.

Cycle of Events

Basically, this engine is of the two-cycle type. It differs from the standard or usual conception in that it has two pistons per cylinder. This construction makes it, in effect, two engines, one inverted above the other, and it is evident that this unique arrangement occupies the floor space equivalent to an engine half its size—and with comparatively little added height. By reason of the unusual piston arrangement, cylinder heads, liner joints, valves, rocker arms and push rods are eliminated.

The pistons move toward one another to compress the air charge, and perform the following functions: Due to the 12-degree lead of the power piston, the exhaust ports close slightly ahead of the intake ports allowing the cylinder to be slightly supercharged. Then follows the closing of the intake ports and the beginning of compression. Slightly before the end of compression, fuel has started to be injected, and compression is taking place. This combustion continues during the initial part of the outward stroke and the heating of the charge and its consequent expansion takes place. Expansion continues, with the characteristic drop in cylinder pressure through the power stroke.

Again, due to the 12-degree lead, the exhaust ports open first, permitting the cylinder pressure to drop. The scavenge ports open slightly later and the cylinder is swept clean by the incoming air charge. This action provides efficient "straight-through" scavenging without the use of valves. When the pistons pass their dead centres and begin to move toward each other,

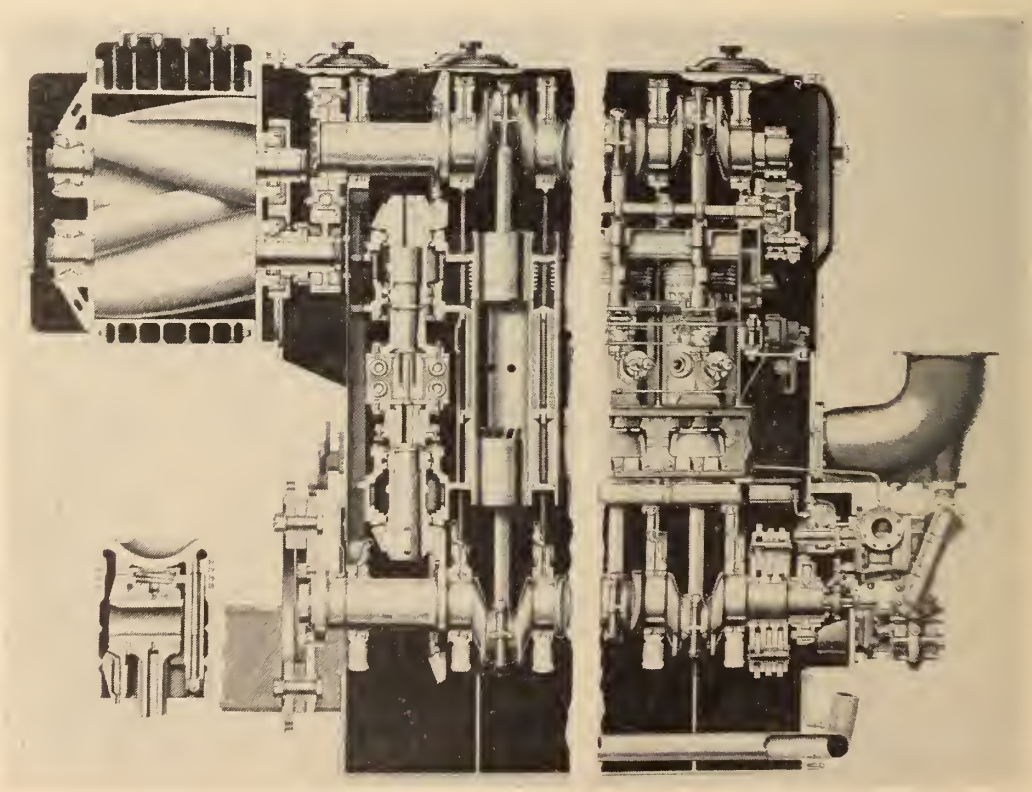


Fig. 6. Ten cylinder (O.P. 8⅛ x 10 diesel) locomotive engine—longitudinal section. A.DF. Fairbanks-Morse & Co.

the cycle is again repeated. Swirl persists.

Timing Diagram (Figure 4)

The diagram is plotted with reference to the rotation of the lower crank. At 0 degree, the lower piston is at inner dead centre, at the top of its stroke. The fuel is being injected at this point. The pistons are driven apart by the pressure of the combustion gases, causing the crankshafts to turn. When the lower crankshaft has turned 124 degrees, the lower piston begins to uncover the exhaust ports. Then 16 degrees later, the upper piston begins to uncover the air ports at the top of the liner.

For 96 degrees of rotation, both ports are open and scavenging takes place. Now, after the crank has made 236 degrees of rotation—56 degrees past outer dead centre—the exhaust ports close but the air ports remain open for a further 8 degrees of rotation as shown. Then both sets of ports are closed and compression proceeds. Before the crank reaches inner dead centre, injection of fuel begins. Just where this will start depends on the load on the engine.

At full load, the injection begins approximately 13 degrees before the lower piston reaches inner dead centre as shown in the diagram. If the load is reduced, such as during part throttle operation, the start of injection will be later. However, under all loads, the injection will end at the same point, when the lower crank is past inner dead centre. It will be noticed that we have referred to the lower crankshaft only, not to both crankshafts. This is because the lower shaft has a 12-degree lead in rotation over the upper shaft.

The main purpose of the 12-degree lead is to obtain the timing of the inlet and exhaust ports. This timing gives us the efficient scavenging which produces maximum power and efficiency. The engine would run and give very fair results with no lead of the lower crankshaft. As a matter of fact, the same engines are used in marine service where they must be reversible.

When operating in reverse, the lower crankshaft is, of course, 12 degrees behind the upper shaft instead of 12 degrees ahead. With this rather radical change in timing of the ports, the engine functions at approximately 30 per cent reduced power. In this case, the engine is, in effect, operating with less efficient scavenging and without supercharging.

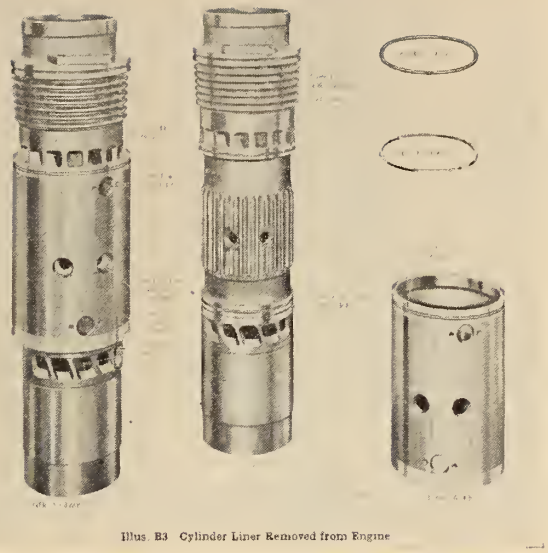


Fig. 7. Cylinder liner removed from engine.

Division of Power

The 12-degree rotational lag of the upper crankshaft, as explained, has a profound effect upon the division of power between the two crankshafts. Thus, the upper crankshaft delivers a smaller share of the total engine power. Furthermore, since the power required for driving the blower and the injection pumps is also taken from the upper crankshaft, there remains about twenty per cent of the total power to be transmitted by the vertical drive shaft to the lower crankshaft.

The areas of the diagrams represent the work delivered to the respective cranks. The greater area of the lower crank diagram is best explained by considering, for instance, the point on the expansion curve where the gas pressure is still 500 psi. At that moment the upper crank is in its 203-degree position or 23 degrees past its dead centre, while the lower crank is already 12 degrees farther in its travel or in the 203 + 12 = 215-degree position (35 degrees past dead centre).

The difference in area between the upper and the lower indicator diagrams can perhaps be more simply explained in the following manner: With the 12-degree advance of the lower crank, the lower piston reaches its inner dead centre having done slightly less work in the compression of the charge than the upper piston, which, for a given stroke position, has had to contend with higher pressures throughout its inward travelling. Conversely, during the outer stroke, again due to the 12-degree lead, the lower or exhaust piston is able to extract more energy from the expanding charge in the power cylinder. For a given piston position on the outward stroke, the lower piston has had the advantage of higher cylinder pressures. (Figure 5.)

Cylinder Block

The block is all-welded construction. One striking and advantageous aspect of the opposed-piston design as used in this engine is notable insofar as it reflects the simplicity of the cylinder block design. With the elimination of the usual cylinder head, we have in this design the simplified problem of transmitting frame stresses directly between the upper and lower crankshaft supports.

The liner is cast iron, with a welded steel water jacket as shown at the right. The jacket and liner are furnished as an assembly and shown disassembled in this view only for explanation of the construction. The water flow is directed, by the ribs shown, to promote even cooling. The openings at the top and bottom of the jacket are for water connections. There are two openings at the middle of the liner and there are two similar ones on the other side. One opening of each pair is used for the injector. The other is for air starting connections on engines for power plant or marine use. Liners shipped out to the railroads for locomotive service have only two holes, one on each side, for the injectors. Note that the upper ports or air ports are designed to promote tangential flow during scavenging, both to obtain thorough scavenging and to promote turbulence in the charge of air during compression. (Figures 7 and 8.)

The important point of the liner

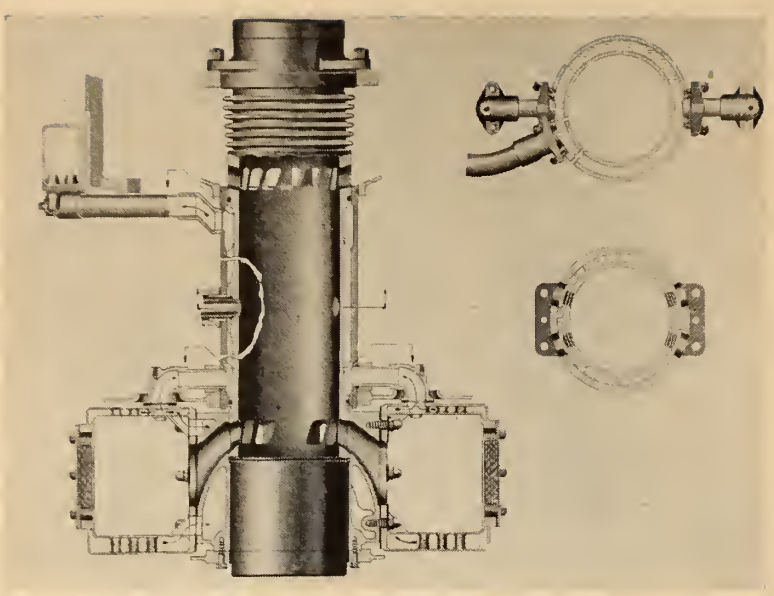


Fig. 8. Model 38D8⅛ O.P. diesel engine cooling system. J.DE. Fairbanks-Morse & Co.

construction is that it is secured to the block at its upper end only and is free to expand or contract. Yet there are no liquid-tight joints to maintain between the liner and the block. The water connections to the cylinder liners are seal ring joints. They are easily checked by visual inspection and can be quickly repaired if necessary.

Upper and Lower Crankshafts

The crankshafts are alloy cast iron having a high tensile strength and a Brinell hardness at the bearings of about 300. They are cored for lightness and dynamically balanced. The upper crankshaft carries a gear for driving the blower which embodies a spring drive, and also a sprocket for driving the two camshafts through a timing chain.

To the lower crankshaft is flanked the main power take-off coupling of flexible laminated disk type. The opposite end of the lower shaft carries a gear for driving the two centrifugal water pumps, one gear-type oil pump, one small fuel-delivery pump, and the hydraulic or electric governor.

The main bearings are precision type. They are readily removable for inspection and, if necessary, replacement. No shimming or adjustment of the caps is required. Each crankshaft is provided with a thrust bearing adjacent to the vertical drive gear at the location shown. These bearings are subjected only to thrust forces developed in the engine itself.

All traction generators used in Fairbanks-Morse locomotives are provided with thrust bearings which absorb any thrust in the generator. Spiral bevel drive gears on the crankshafts mesh with pinions on the vertical drive.

Crankshaft Vertical Drive

The vertical drive consists of two bearing housings, each containing thrust and radial roller bearings for the two pinion shafts. A flexible coil spring coupling unit is provided with both vertical and torsional flexibility. The vertical flexibility allows for expansion of the cylinder block when the engine becomes warm. The torsional flexibility absorbs any torsional vibration between the two crankshafts. A taper arrangement, below the spring unit, allows for adjustment of the timing relationship of the upper and lower crankshafts. Such adjustment is made only if it should be necessary to replace a crankshaft or a vertical drive gear or pinion.

Piston and Connecting Rod

Trunk-type cast iron pistons are used in which the wrist pin is held in a separate insert secured to the piston crown with four studs. With this design the piston has an even wall thickness all around since the piston-pin bosses have been eliminated. This feature does away with the tendency of the piston to change its shape as a result of heat distortion and internal strains. It also prevents escape of cooling oil to the cylindrical outside surface of the piston.

By utilizing the space between the insert and the piston for circulation of oil, effective cooling of the piston crown and the compression rings is provided. The cooling oil is supplied through drilled passages in the crankshaft and the connecting rod. After passing through the cooling channels of the piston, it is ejected through a nozzle.

The connecting rod is drop-forged from alloy steel and rifle-drilled. It should be noted that the lower rod is longer than the upper one. The pistons are provided with four compression rings. The use of three oil wiper rings has been found effective in controlling the piston lubrication, even though the upper piston is operating in an inverted position.

Oil, received from the drilled crankshaft, passes through the drilled connecting rod, around the annular groove in the connecting rod eye bushing, out a hole in the end of the connecting rod into the cooling oil cavities of the pistons. A spring-loaded oil retainer is fitted over the connecting rod end to direct the oil into the piston and to keep it from escaping back around the outside of the connecting rod. The oil leaves the piston through the cooling oil outlet. Each tappet assembly contains a roller and a spring-loaded push rod, as shown, which operate the fuel injection pump shown at the lower portion of the slide.

Fuel Injection System

The fuel injection pump is of the constant stroke, variable displacement type. In general, the fuel injection pump is of the conventional type except that the amount of fuel per stroke is controlled by varying the point at which injection begins. The heavier the load, the earlier injection starts. As the injection stops at the same point for all loads—past the inner dead centre of the lower cranks—this earlier start of injection will, of course, cause more fuel to be delivered per stroke.

Note that the pump operates in an inverted position and thus requires no priming. The control rack is marked with graduations. A pointer is provided on the pump body. Thus we can read the position of the racks and determine whether the engine is properly loaded.

When the pistons are approaching inner dead centre the fuel is sprayed into the fast-rotating swirl of compressed and heated air by two injection nozzles. These are located in each cylinder, diametrically opposite on either side of the engine. The air swirl and the use of the double-injection system are two important factors contributing to

(*Continued on page 502*)

Concrete Aggregates

by

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A paper presented on March 27, 1951, before the Civil Section of the Montreal Branch of The Engineering Institute of Canada.

The selection of aggregates for concrete requires consideration of factors which must be weighed against one another to find the material which will give concrete of satisfactory quality at the lowest cost. The amount of investigation which is justified depends on the project. If it be small, much time cannot be spent on this, but even on comparatively small structures, saving can often be effected by the investigation of all practicable sources of supply before coming to a decision, e.g., if suitable gravel is available, it is usually cheaper than stone and sand, and if it is purchased by volume, there is a further saving because of the greater weight of aggregate in a cubic yard of gravel.

If a project be where full information of the local aggregates is unavailable, a survey should be made of those deposits within hauling distance to determine the most suitable economic aggregate available. This survey should be made as early as possible, because once the contract is let, there is a rush to get the job started, and if there be not time to give aggregates proper consideration, it may be that a more expensive aggregate than necessary will be purchased.

Specifications are often drawn up before it is known exactly what aggregates are available and they are sometimes unnecessarily strict. The purpose of specifications is to ensure that the concrete in a structure shall have the required strength and durability. Specifications should not be so strict that they demand the use of costly material, when a cheaper or more easily procurable one will give satisfactory results. Quality of aggregates should of course be carefully defined and definite limits and tolerances laid down. Grading, however, should not be too closely restricted, especially for coarse aggregate, because this chiefly affects the cost of the concrete and the contractor should be allowed as much latitude as possible in selecting his materials. This policy is suggested by the American Society for Testing Materials (A.S.T.M.) in its specification C33-49 for concrete aggregates, under the heading "Quality of Aggregates".

Selecting a suitable and economical concrete aggregate is not entirely a matter of adhering to standard specifications. Other factors should be considered and a broad view of specification requirements assumed, as is suggested by the author in this paper.

There is much more to selecting an aggregate than merely following a specification; good judgment based on experience is necessary. Ideal aggregate is not likely to be available. The grading may not be what is desired or there may be flat particles or unsound stones present. Sand may contain excessive clay or silt, or it may be deficient in fines. By overcoming these objectionable features, satisfactory aggregate may be made available. Grading may be improved by blending in other material; investigation may show that unsound stones are likely to break up in handling or in the mixer and end as fine aggregate; sand may be washed.

In selecting aggregates, consideration must be given to the type of structure in which the concrete will be used and the service to which it will be exposed. Aggregates for use in a dam should be examined more critically than those for the footings and foundation walls of a building.

Aggregates are classified principally by their physical properties, such as size, grading, shape, density, strength, absorption, surface texture and cleanliness. Chemical properties are not usually of much practical interest in the aggregates commonly found in Eastern Canada.

Coarse Aggregates

Coarse aggregate must be physically sound and durable to be satisfactory. If it is too absorbent, or easily split, or if it swells when saturated, it may cause cracks or spalling when used in concrete. If it has too smooth a surface, or is coarsely crystalline, it may provide a poor bond with the cement paste. These requirements can usually be determined by visual examination, but if there is any doubt about them, tests should be carried out on the material. In brief, the object is to select the aggregate so that the concrete will be workable, durable, of satisfactory strength and fulfil any special requirements, such as being weather-resistant if exposed outdoors, or abrasion-resistant for floors.

Coarse aggregate is secured either by crushing stone or by separating and possibly crushing gravel. There is no recognized nomenclature by which the various sizes of stone are identified, as each crushing plant has its own definition of the sizes turned out, e.g., when one plant mentions ¾ in. crushed stone, it may mean everything from ⅜ in. to ¾ in. with nothing larger than ¾ in., while another firm may mean all stone between ¾ in. and 1 in. It is therefore not a definite specification to state that ¾ in. stone is to be used.

The different standards for sizes of crushed stone specify the size of the aggregate, not by a single dimension, but as the material between two nominal sizes. There is considerable variation between authorities, but this is not important from a practical point of view. In all cases,

coarse aggregate is defined as material retained on the No. 4 square-mesh sieve. [See References ①, ②, ⑫ and ⑬.]

The Canadian Standards Association (C.S.A.) ③ figures for the more usual sizes are given in Table I following.

The maximum size of coarse aggregate used will depend on the type of structure to be built, the sizes of the sections and the spacings of the reinforcing steel. Usually, it is specified as one-fifth to one-quarter of the thickness of the sections of concrete and three-quarters of the minimum clear space between reinforcing bars. The National Building Code ④ uses one-fifth of the thickness of the section and two-thirds of the clear space between bars. The Montreal Building Code ⑤ is similar, except that it uses three-quarters of the minimum clear spacing between bars and states that the maximum size of aggregate must not be greater than the clear distance between reinforcing bars and forms. The Toronto Building Code ⑪ requirements are similar to those of Montreal. The equipment for mixing and placing also has some bearing on size.

Writers of specifications are likely to specify coarse aggregate too small for economy, the principal reason probably being that they wish to make sure it will all pass between the reinforcing bars. This is theoretically desirable, but in practice if some of the stones are held back by the steel, other smaller stones and paste flow around them and they are soon buried. Many contractors prefer to use smaller stone than is economically desirable, because it places more easily. The saving in cost of placing must be balanced against increased cost of concrete made with smaller stone in any comparison of this kind.

Table II, which is taken from an article by Walter H. Price, Materials Engineer, Bureau of Reclamation, Denver, Colorado ②, indicates how the cost of concrete is affected by maximum size of aggregate used.

The gradings for coarse aggregates given in Table I are for the purpose of getting as large a volume of coarse aggregate as possible into the concrete. The fewer voids there are, the less cement-paste is required to fill them and the cheaper the concrete. Much concrete used in ordinary structures is made with coarse aggregate which is not graded and therefore requires more cement for a given strength. In many cases this is unavoidable, because of the extra cost of using several sizes, but where graded coarse aggregate can be used, it will be found that for a given quantity of cement per yard, the strength of the concrete will be increased.

Coarse aggregate may be weak because the rock grains may be poorly interlocked or poorly cemented together, or because the grains themselves are weak. The best place to examine aggregate is at the quarry or in the pit, as a visual inspection will give considerable information regarding its suitability. Unsound material may be readily picked out and an examination of outcroppings or boulders which have been exposed to the weather for some time will show whether the aggregate will resist freezing and thawing. It is by resistance to weathering that the physical strength of aggregate is judged.

Material which has high absorption, or which swells when wet, or is easily cleavable has low physical strength and is not satisfactory. Crushed limestone is commonly used and by itself is an excellent material. However, some limestone contains layers of shale, which reduce the quality of the aggregate crushed from it. Shale is clay or silt which has been deposited in layers by water. Sometimes there is a certain amount of lime present, at other times there is none. This clay, after subjection to geological consolidation, becomes a sound-looking material with a more or less laminated structure. Alternate wetting and drying of shale tends to cause it to disintegrate into flat pieces, an action which is even more pronounced if it be exposed to freezing and thawing.

It cannot be said that any particular material will make satisfactory aggregate, unless something is known about the particular deposit in question, e.g., sandstone is often soft and easily broken if the grains are not well cemented together, but it can be a dense hard material, quite suitable for use in concrete.

Where nothing is known about a deposit and visual examination does not show whether it will stand up to freezing and thawing, it is usual to test the material for soundness in the laboratory by the use of sodium sulphate or magnesium sulphate. In passing, it may be said that while failure of concrete due to freezing and thawing may be partly due to the coarse aggregate, it is usually caused by the cement paste being of unsatisfactory quality or by the fine aggregate being deficient in fines.

The shape of pieces of crushed rock depends on the presence or absence of natural cleavage planes. Thus shales and some fine-grained rocks produce flat and splinter-shaped fragments, while granite and limestone give chunky pieces. Flat and elongated particles do not pack well, which means a larger proportion of voids to be filled with cement paste; also they may arch over other pieces, thus causing structural weakness. They have a detrimental effect on the workability of the concrete, though a moderate percentage of flat or elongated fragments is not serious. (6, p. 59.)

Surface texture, that is, roughness of surface and size of pores, affects the bond between stone and cement paste and consequently the strength of concrete. It is not always easy to evaluate the degree of bond which will be developed from surface texture, as some stones which would appear too smooth and hard for good bond give high strengths in practice. For instance, the beach gravel which is used as coarse aggregate at Saint John, N.B., is hard and smooth, but it tends to give higher strengths in concrete than similar beach gravel used in Halifax, N.S., which is not so hard and smooth. The physical

TABLE I

Grading of Coarse Aggregate for Commonly-designated Sizes

Designated Sizes	Percentage by weight passing laboratory sieves having square openings								
	2½″	2″	1½″	1″	¾″	½″	⅜″	No. 4	No. 8
No. 4—½″					100	90-100	40-75	0-15	0-5
No. 4—¾″				100	90-100		20-55	0-10	0-5
No. 4—1″			100	90-100		25-60		0-10	
No. 4—1½″		100	95-100		35-70		10-30	0-5	
No. 4—2″	100	95-100		35-70		10-30		0-5	

TABLE II

Quantities of water and cement required per cubic yard of concrete with different maximum sizes of aggregate—slump = 3 in.; water-cement ratio = 0.53

Max. Size	½″	¾″	1″	1½″	2″
Lbs. water per yard	345	320	310	290	285
Canadian bags cement	7.4	6.9	6.7	6.2	6.1

TABLE III

Substance	Permissible limits per cent by weight: Recommended	Maximum
Soft fragments	2	5
Coal and lignite	¼	1
Clay lumps	¼	¼
Shale	1	1½
Material finer than No. 200 sieve	½	1

character of the surface of aggregate must be studied in combination with other qualities, such as particle shape and general suitability.

The specific gravity of the aggregate is not usually important unless lightweight or heavyweight concrete is desired. It is useful to know it, as it gives an indication of the density of the stone, a low specific gravity often, though not always, indicating a more or less porous aggregate and a high specific gravity indicating dense material. It is necessary to know the specific gravity if the weight per cubic foot of concrete is to be calculated, as is done in determining the air content. It is also necessary to know the specific gravity to determine the weight of a cubic foot of solid rock when calculating the amount of voids in crushed stone. The average aggregates in common use have a specific gravity of about 2.65, which gives the weight of a cubic foot of solid material as 165 pounds. The weight of ungraded compacted coarse aggregate runs from 95 pounds to 110 pounds per cubic foot, giving from 42 per cent to 33 per cent voids. For graded coarse aggregate, there will be about 5 per cent less voids.

Resistance to abrasion is usually not important in concrete so long as the aggregate is strong. For roads and floors where wear resistance is important, however, this should be considered when choosing a coarse aggregate.

Some aggregates, such as shale, expand when they become wet and shrink as they dry, thus setting up internal stresses which may cause concrete to spall if their particles are close to the surface. Another type of stress may be caused because the change in the volume of the aggregate with temperature variations is different from that of the cement paste, or by large differences in the coefficients of expansion among the aggregate particles (6) (8) (9).

By coatings are usually meant the deposits of clay, silt or calcium carbonate from ground water which form on the surfaces of pebbles, sometimes bonding smaller stones to the pebble or bonding several pebbles together. These are seldom met with in Eastern Canada and are not of practical importance.

If there is clay present in a gravel pit, there may be a deposit of it on the pebbles. A small percentage of clay, which will be removed during the mixing process, is harmful only because it increases the water requirements of the mix. Tightly-bonded clay coatings, which are not removed during the mixing process, tend to lessen the bond between the aggregate and the paste and thus reduce the strength of the concrete (7).

There is often dust present on crushed limestone; a small amount of this is not objectionable as it will be rubbed off during the mixing, except that it may come to the surface as laitance. This dust may come from shale in the limestone which has broken down into clay particles during the crushing operation. A small amount of clay in the mix will make the concrete more plastic. The A.S.T.M. and C.S.A. specifications recommend that the amount of crusher dust be limited to one-half percent by weight with a maximum of one and one-half percent allowed. However, in tests reported in the A.S.T.M. Proceedings for 1930, it appears that concrete made with stone coated with 5.7 percent of dust by weight showed no loss in strength (10).

The following are the amounts of deleterious substances allowed in coarse aggregate by C.S.A. Specification A23-1942 (3). A.S.T.M. Specification C33-49 (1) is the same, except that no mention is made of shale.

Fine Aggregate

Sand, by definition, is clean rock particles varying from very fine to 3/16 in. in size. Most concrete sand deposits contain some material larger than 3/16 in., but this is considered as part of the coarse aggregate. The most important properties of a sand are its grading and its cleanliness.

The grading of aggregate is expressed as the percentages retained on a standard series of sieves where the openings in any sieve are twice the size of the next smaller one. For fine aggregate the sieves used are:

TABLE IV

Number	Sieve Opening: Mm.	Inches
4	4.76	0.187
8	2.38	0.0937
16	1.19	0.0469
30	0.59	0.0232
50	0.297	0.0117
100	0.149	0.0059

These and other sieves for testing purposes are described in A.S.T.M. Standard E11-39 (14).

When the cumulative percentages retained on these sieves are added together, and the sum divided by 100, the result is called the "fineness modulus" of the sand. This is an empirical factor which is used as an index of coarseness or fineness.

The gradings recommended by various authorities agree substantially, although there is no universally accepted "ideal" grading (13). Following (Table V) are limits for cumulative per cent retained which are recommended by some organizations.

Sand which has a grading finer than the lower limits specified is too fine to be economical, as it requires extra water and consequently more cement for a given strength. Sands that are coarser than the above are likely to be too harsh to give a satisfactory plastic mix.

From the standpoint of quality of concrete, the grading of fine aggregate is more important than the grading of coarse aggregate. Poorly graded sand, with too much of it the same size is undesirable. Too much or too little fines will not give best results. The fines are necessary to give good workability and weather resistance. If there are not enough fines to fill the small voids, the concrete will not be as dense as is desirable and will not stand up as well to weathering. If the concrete is relatively rich, sand which is lower in fines can be used as the extra cement functions as very fine sand. If the sand is deficient in fines it

TABLE V

Sieve	CSA Specification A23-1942 (3)	ASTM Standard C33-49 (1)	Joint Committee Report (12)
No. 4	0-5	0-5	0-5
8	..	..	..
16	20-55	20-55	20-55
30	..	..	..
50	70-92	70-90	70-95
100	92-100	90-98	92-100

may be improved by adding a small percentage of very fine sand. If it is to be used indoors or below ground, where it will not be exposed to freezing and thawing the lack of fines may not be important.

In drawing up a specification for the grading of fine aggregate, it should be qualified in such a way that the engineer may be able to use his judgment in selecting the material. Because the grading of sand is a few per cent outside the limits set does not necessarily mean that it is unsatisfactory.

Sand must be free from injurious amounts of organic impurities. The standard method of test is carried out by filling a 12-oz., graduated, clear glass bottle to the 4½-oz. mark with sand to be tested. A three-per-cent solution of sodium hydroxide is added until the volume of the sand and liquid after shaking is seven liquid ounces. The bottle shaken vigorously and allowed to stand for 24 hours. The colour of the clear liquid above the sand is then compared with the colour of a standard reference solution. Solutions darker than the standard colour indicate the presence of more than 500 p.p.m. of tannic acid. If a colour lighter than standard is obtained the sand passes the test satisfactorily, but if the colour is darker further investigation must be carried out to determine the nature of the material and its effect on time of set and strength of concrete.

The permissible limits for deleterious substances in fine aggregate given by the C.S.A. are as listed in Table VI (3, p. 16).

Silt, shale, clay and clay lumps in any amount are undesirable because they increase the water requirements of the concrete and because clay swells when wet and shrinks when drying. Mica is a common contaminating substance in sand. It is soft and disintegrates readily, so that it may reduce the strength and the durability of the concrete. Washing the sand will usually take out most of the clay coatings and mica, as well as the organic matter, but clay lumps are very difficult to remove. Washing may also take out some of the finer sand unless it is carefully done.

On the Atlantic coast the question sometimes arises as whether sea sand may be used. If the sand is piled and allowed to drain, the amount of salt present will have no practical effect on the concrete. Atlantic sea water contains about 3.8 per cent salt so that if the sand contains 5 per cent moisture, the actual amount of salts present is only about three pounds per cubic yard of concrete.

Gravel

The investigations made into coarse aggregate and fine aggregate are for the purpose of finding two or more materials which may be mixed in proper proportions to give a suitable combined aggregate with a minimum of voids.

Gravel is a natural combined aggregate, which is often suitable to use as it is or with some adjustment. It must consist of clean material having a satisfactory grading which is fairly uniform throughout the pit. It makes stronger concrete than crushed stone and sand, with the same cement content because it has fewer voids and requires less water and cement paste to give a workable mixture.

Whether the gravel can be used just as it comes from the pit depends on the type of structure in which it is to be used, as well as other considerations. It may be satisfactory as it is for concrete in a building, whereas for a dam it would be necessary to separate it into coarse and fine and recombine it. If there is sufficient stone of suitable size present it may require screening only, but if it is short of stone it may be necessary to crush the larger pebbles and cobbles. If it is lacking in fines it may be necessary to add sand.

When the material is not uniform throughout the pit it is often possible by close supervision to have it taken out from different locations, moving from one place to another so that if one truckload contains too much coarse aggregate, the next truckload will be mostly fine. When these are mixed in the stockpile a reasonably uniform material is obtained. It is often specified that pit gravel must be separated and recombined, when with care the pit run can be used just as satisfactorily and at lower cost.

The requirements for grading of gravel, deleterious substances, organic content, etc., are the same as those applying to coarse and fine aggregate. One thing which must be carefully looked for in gravel is unsound material, pieces of shale or soft or friable stone. If too large a percentage of this type of material is present, the aggregate should not be used. However, a small amount, while objectionable, is not too important. A piece of unsound aggregate which is buried deeply in good concrete is not likely to cause any trouble, but if it is near the surface and the cement paste is not properly impervious, weathering action may cause a piece of the concrete to spall off. This is usually of little importance structurally, and unless appearance is important, the hole can be patched. As long as this is realized in advance, the presence of a small amount of unsound stone in the coarse aggregate need not be taken too seriously.

If the larger stones are to be crushed, care should be taken to see that the screen separating the allowed maximum size from the oversize has openings large enough to allow a reasonable amount of maximum size aggregate to pass. For instance, if 1½-in. aggregate is allowed, a 1¾-in. screen may let only a small amount of 1½-in. pass, and it may be that a 2-in. opening is required. The proper screen to use may have to be settled by experiment. For important concrete work where it is advisable to separate and recombine the coarse and fine aggregates, a ½-in. screen is about the smallest that is practical. Anything smaller will clog in wet weather.

Since gravel contains a larger range of sizes of particles than either crushed stone or sand, it needs careful handling and stockpiling to avoid segregation. It cannot be dumped in conical piles, because the fine material remains in the centre while the coarse stones roll down the outside. Neither should it be built up in the form of a high pile, with trucks dumping over the end because the same action takes place. It should be built up in layers in flat piles, each truck load being dumped as a unit and the pile levelled off with a bulldozer. When material is taken

TABLE VI

Substances	Per cent by weight	
	Recommended	Maximum
Clay lumps	1	1½
Shale	1	1½
Coal and lignite	¼	1
Material finer than No. 200 sieve		
(a) in concrete subject to surface abrasion	2	3
(b) all other classes of structures	3	5
Other deleterious substances	as specified	as specified

out of one side of such a pile a cross section from many loads is mixed, thus supplying a reasonably uniform grading to the batching plant. (6, p. 187.)

Stockpiling of the fine aggregate, from ½-in. down, by itself, especially if it is damp, is much simpler than stockpiling of pitrun material since it does not segregate so easily. Also, in digging it out, when the pile gets beyond the angle of repose, the whole side may slide down and mix the sand thoroughly.

Testing Aggregates

It is very important when investigating aggregates, that the samples which are taken for laboratory examination be representative of the material. It is not enough to send a man to a gravel pit with a bag and tell him to put a couple of shovelsful of gravel in it. Care must be taken to include the approximate proportions of the various sizes in the pit and the samples must be taken from far enough in from the face to make sure that no surface organic material is included. Taking a sample of sand or crushed stone is simpler, but it also requires judgment to ensure that it is representative. (2, p. 74.)

It may perhaps seem unnecessary to say that a label should be put in with the sample without delay, giving the location of the deposit, the name of the owner, and the company which is interested in using the material.

Only sieve analyses and organic tests are necessary for ordinary aggregates from a locality the history of which is known. When new sources of supply are opened, further tests may be desirable. In most cases these tests do not reflect actual conditions existing in service, since they must be made in the laboratory, but when interpreted with judgment, they give some indication of what may be expected from the material when used as a concrete aggregate. No good purpose would be served by describing these tests here. Detailed directions for performing them are given in the publications of the A.S.T.M., the C.S.A., the American Association of State Highway Officials and other similar organizations, and new methods of testing are being constantly devised.

Light Weight Aggregates

Light weight aggregates are used principally for fill, for fireproofing or for precast units, such as roof slabs. Their weight per cubic foot may run anywhere from 35 to 115 pounds, with compressive strengths roughly proportional to the weight.

Except for cinder concrete, the cost of light weight concrete is higher than ordinary concrete using the same amount of cement. It can be used, therefore, only where its particular qualities justify the added cost. Its fire resistance and insulating value against heat and sound are better than those of heavier concrete, and where dead load must be kept down the lower weight is important.

The workability of the concrete is poor, all light weight aggregates having a characteristic harshness caused by porosity and angularity. In many cases, there is lack of grading and the larger and lighter particles are likely to float to the surface. The slump needs to be kept down and the concrete should not be manipulated too much. The finished surface of light weight concrete is likely to be rough.

The usual specifications for ordinary aggregates apply to some extent, that is, grading, organic tests, deleterious substances and so on. The A.S.T.M. has a specification for "Light Weight Aggregates for Concrete", No. C130-42, but the C.S.A. has not yet issued any.

The A.S.T.M. specifies the maximum unit weights of dry light weight aggregate as 75 pounds per cubic foot for fine and 55 pounds per cubic foot for coarse aggregate.

There are only three light weight aggregates in normal use in Eastern Canada, cinders, haydite and vermiculite.

Cinders vary greatly and should be secured from a satisfactory source where the quality runs fairly uniform from week to week. Usually it is specified that there must not be more than 25-35 per cent of combustible matter present, based on the weight of the dry aggregate. Sulphur present as sulphides should not be more than 0.45 per cent, and sulphur trioxide as sulphate should be less than 1 per cent (21, p. 166). There are some objections offered to the use of cinders because of the possible presence of deleterious sulphur compounds which might attack reinforcing steel. However, if the concrete is dry it is questionable if the steel will be attacked. Some authorities believe that the cause of the occasional corrosion of steel in cinder concrete is largely lack of protection from air and moisture (22). Cinders are very harsh to use in concrete and should be properly graded, otherwise it may be necessary to add sand.

Concrete for fill using three bags of cement per cubic yard has about the following weights:

All cinder aggregate: 88 lbs. per cu. ft.

50% cinders and 50% limestone screenings, 137 lbs. per cu. ft.

70% cinders and 30% fine sand: 99 lbs. per cu. ft.

Haydite is shale which has been heated in comparatively large pieces to the fusion point. The combined water in the shale turns to steam which blows the shale up. It is then crushed to desired sizes. It is similar to pumice, only artificial. Without sand added, haydite concrete will weigh 90 to 105 pounds per cubic foot. With sand added the weight will be about 105 to 120 pounds (21). Fine haydite itself weighs 50 to 60 pounds per cubic foot and coarse haydite about 40 to 50 pounds.

Vermiculite is a type of mica which, when heated, expands to a fluffy mass having a volume as much as 30 times the original volume. It is a good insulating material. Its weight per cubic foot is about 5 to 15 pounds and concrete made with it will weigh 30 to 75 pounds per cubic foot.

Perlite is a material which expands when it is heated. Graded rock is placed in a furnace which rapidly heats the particles to about 2,100 F. when the rock expands up to ten times its original volume. It is then quickly cooled and removed. It is light, weighing only 6 to 12 pounds per cubic foot, but the hard glassy nature of the material gives good strength in concrete. The concrete weighs about 50 to 80 pounds per cubic foot. The only known deposits of perlite of economic importance in Canada at present are in British Columbia. So far no deposits of interest have been found in Eastern Canada.

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THE OPPOSED-PISTON DIESEL ENGINE

(*Continued from page 496*)

excellent mixing of the fuel with the air, resulting in clean combustion and good economy. The fuel is delivered to each nozzle through a short heavy wall tube by an individual injection pump for each nozzle. These injection pumps are arranged in two banks, one on either side of the engine.

Scavenger Air Blower

A flexible blower drive is used which tends to absorb vibration transmitted from the upper crankshaft. The blower supplies air to the cylinders under a pressure up to approximately six pounds per square inch, depending upon load and speed. The blower delivers approximately 1.5 times the engine displacement and rotates at approximately twice the engine speed.

A connection is provided between the suction side of the blower and the vertical drive compartment to exhaust vapours from the engine crankcase. This line has a separator to prevent picking up of oil and its mixture with the scavenging air.

Lubricating Oil Circulation in the Engine

We need not trace the circulation of the oil in detail. In general, the engine can be classified as being of the "wet sump" type. Oil under pressure is supplied to all vital wear points. Through manifolds, piping connections and drilled passages, the oil is forced to the bearings, pistons, etc. Note that there are no oil passages in the cylinder block proper. Drilled holes conduct the oil in shafts and rods only. All other lubricating oil connections are composed of tubing. The same oil serves as a coolant for the pistons.

Engine Jacket Cooling Water System

Water is circulated by the engine-driven water pump. From the engine, the water passes through radiators on each side of the locomotive and then returns to the suction side of the water pump. The pump forces the water along passages surrounding the exhaust manifolds.

At each cylinder, the cooling water enters passages in the exhaust belt, cooling the belt and the part of the liner below the exhaust ports. The cooling water also passes through elbow connections, on each side of each cylinder, to the lower part of the cylinder liner. The water flows upward along the liner and where heat transfer is most intense through passages formed by the vertical cooling fins of the liner. These fins serve to increase the water velocity and also increase the cooling surface at this critical area.

An important design feature is noticeable here. Throughout the entire engine, the water flows only through replaceable parts and at no time does it come into contact with the welded cylinder block. Possible corrosion of stress members is definitely avoided. At the upper end of the liner jacket, on one side only, a single outlet connection conducts the cooling water to the water outlet manifold. Leaving the manifold connection at the control end of the engine, the water passes to the radiators.

The temperatures in general of these circulating systems are controlled by regulating the flow of air through the radiators. This air flow can be controlled either by variable opening shutters or by variable speed radiator fans. √

Future Annual Meetings

ANNUAL MEETING, 1953 . . .

Nova Scotian Hotel, Halifax, N.S., May 1953

ANNUAL MEETING, 1954 . . .

Chateau Frontenac, Quebec, Que., May 12-14, 1954

Report of Committee on Adequacy and Standards of Engineering Education

S. C. Hollister, *Chairman* C. S. Crouse L. F. Grant M. D. Hooven

Presented at the 19th Annual Meeting of the Engineers' Council for Professional Development held at Boston, October 1951

Introduction

The aim of this report is to present at least in spirit the impressions of your committee concerning the adequacy of present-day engineering education and observations relating to what it estimates to be the standards employed by the engineering schools. Any attempt to appraise the present position of engineering education is destined to cause a certain amount of misunderstandings, due largely to the attitude of the reader at the time, and the impression the words convey in the climate provided by that attitude. Specific statements are often too limiting when taken literally, and generalizations are often too vague. An endeavour has been made, however, to present for consideration the committee's views on the present situation with the hope that, though brief and at times over-simplified and specific, the main observations will be accepted in their intended perspective.

Growth of Engineering Curricula

Engineering education in America was not developed after a preconceived plan. It evolved in parallel with the needs of a growing country engaged in the development of a vast industrialization. From the first it filled a practical need, and its design emanated largely from an evaluation of the professional requirements.

There were only a half dozen schools of substantial merit by 1866. While the concept of engineering was the application of science to useful purposes, the educational program was heavily charged with the art of engineering practice. The better curricula had their roots in scientific studies. At that time, and for a generation to follow, a majority of practising engineers were not engineering college graduates; they were men who through experience, observation and study, developed themselves to the point where they could cope with the technical problems of their time. Books began to appear and, with the development of laboratories for the teaching of principles (which, by the way, had been by 1870 in operation for 15 years in the Chemistry Department at the University of Michigan), gave strength to the program of the colleges in systematization of technical knowledge.

With the passage of the Morrill Act in 1862 the means and urge to found in each state a program in the mechanic arts for the aid of manufacturers were at hand. From 1870 to 1896 there was rapid expansion of the number of schools to 110 and the gradual formulation of the curriculum. By 1910 the forms of curricula in the older branches of the profession were pretty well standardized as to pattern. No elevating influences appeared to be at work on other than the newer curricula, such as chemical and metallurgical engineering, until the first World War.

Between the two World Wars the engineering schools developed programs in electronics. Although these and the newer pre-war programs were patterned after the "standard form of curriculum, they nevertheless introduced new elements of strength in the increase of basic and applied science; and it was soon noticeable that they possessed more vitality and potential than the older programs. Yet most schools did little or nothing about these older curricula. Instead, most colleges of engineering were preoccupied with the development of various offerings to cover students interested in the fringe areas: those who would be continguous to, but not really a part of, engineering itself. While these programs served a useful need, their inclusion in one guise or other as *engineering* programs was a clear departure from the earlier concepts of professional training.

During the entire period from the earliest days to the second World War, there was not an established position for the technical school offering a program that would be post-high school, but with more emphasis on high-grade craftsmanship training than on professional education. Many of the earliest schools of this type gradually expanded to four-year programs. A few, having a clear view of the need and great importance of such training, have held to their conviction and have developed strong programs with notable results.

Critical Evaluation of Factors in Engineering College Development

As one examines the history of the growth of engineering colleges and their development, certain features thereof are especially evident. The very rapid expansion in both number and size of schools left little choice than to imitate the more successful. Not so obvious was an underlying situation that many of the new schools had only a dim concept of their objective in service to the profession. There was at work in the same setting the notion of spreading higher education for all, a factor that is restrictive of high standards. As schools grow, the pressure for staff expansion led to recruiting by the simple process of keeping on recent graduates, and then allowing them to do their graduate work, if any, while teaching. In this way, there was a subtle influence of continuity of curriculum with little urge for re-evaluation or vitality of concept of objectives. A standard pattern was achieved, not so much by deliberative process as by a sort of combination of gravitation and inertia.

Coupled with these influences was the circumstance of ever-pressing financial problems in

young and growing schools, and the consequent limit on salary scales. Not a few administrators found themselves unable to pay salaries that would command talent already developed, and in some cases they could do little more than employ something less than the top of the currently graduating class—"temporarily". The deadening effect of obsolescence upon laboratory equipment, some of it hard-won after years of waiting and planning, had its part in gradual "standardization" through the lack of means to preserve a dynamic program.

Over the year, the number of practising engineers without engineering college education was gradually diminishing. This was due in part to the availability of engineering schools, and to an increasing extent to the complicated nature of the engineering function. Between the World Wars, with the introduction in many schools of programs with greatly reduced scientific and technical content, yet calling the output "engineers," there arose increasing confusion as to what constituted engineering and what characterized engineers. Accountants, for example, and graduates of business courses, and others, who had enterprise to pose as consultants on managerial matters, called themselves management or industrial engineers. Graduates of such courses could perform but elementary engineering functions. There can be no question that these courses of reduced technical content were an aid to certain persons; the serious doubt was whether they should have been considered engineering courses.

From the earliest days the program of engineering education was limited to four years, in parallel with the usual undergraduate college program. A very few schools added one or two years, with an additional degree. During the period of development and growth, the medical, legal and architectural professions have extended their length of program to meet their particular objectives. It is significant that these developments had no effect upon the engineering professional program and that in consequence, with conspicuously few exceptions, the engineering curricula have remained four years in length, beginning immediately after high school.

Meantime, the fields of sciences, without exception, have been obliged to extend their programs through the addition of graduate work. Today no scientist is considered adequately trained without the doctor's degree. Whether graduate work is an appropriate program for the professional engineer is one of the questions dealt with by your committee.

Probably the most significant single characteristic of the engineering educational field is that it has no generally accepted professional objective as a goal for the educational program. There is general agreement respecting the form of the curriculum. It is difficult to detect differences in programs between schools simply by comparison of curricula. The major differences lie in the depth of instruction and in the objective of each institution in respect of the professional outlook to be achieved. There exists today a spectrum of objectives ranging from highly professional programs supported by strong science backgrounds to vocational programs in which only a moderate amount of science is included.

It is possible to divide the subjects included in any engineering curriculum into five groups, as follows:

1. Basic science (mathematics, physics, chemistry, biology.)
2. Applied science (mechanics, thermodynamics, fluid mechanics, geology, circuit theory, properties of engineering materials, etc.).
3. Applied engineering (for example, internal combustion engines, structures, machine design, industrial electronics, foundry technology, plant design, etc.).
4. Administrative and managerial (cost control, industrial organization, labour relations, etc.).
5. General (liberal courses, to provide a general educational background). Curricula may vary in the emphasis placed upon group, and in the extent of dominance of one group over the others.

Historically, applied engineering courses dominated the curriculum in the early years. Gradually the pattern of basic science courses was evolved and generally included. Shop courses were reduced to a minimum. From 1885 until the first World War, mathematics was stabilized in the older curricula, terminating with the calculus. Since then only a few schools have carried the subject further in civil, chemical, mining, and mechanical engineering, while many schools have required additional mathematics in electrical engineering. Except in chemical engineering, and in some cases of mining engineering, the amount of chemistry required has been limited to general inorganic chemistry.

The time requirement in physics has remained nearly constant in most curricula since about 1885. Generally, the classical approach to physics instruction has been followed. The depth has varied with the amount of mathematics available at each stage. The calculus, while standard in all curricula, is not employed to the same degree in physics. In civil and mechanical engineering the amount of physics is limited to one year in most schools; and in many the same limit is found in electrical and chemical engineering. Generally, however, the approach from the point of view of atomic and molecular structure is needed but wanting.

The time devoted to mechanics is similar in nearly all schools. The variation in effectiveness of the course is not due to allotted time so much as to the depth of instruction. For many years it was the custom to minimize the use of the calculus in this subject. The development of stronger texts over the last two decades has greatly improved the effectiveness of the instruction; however, there is still much variation in depth of the requirements placed on the student. There may be said to be a definite upswing in the quality of instruction in mechanics, although this is not believed to be general. In mechanical engineering, for example, vibrations and their consequences are treated in only a few schools. In fact, in civil engineering dynamics is regarded as being unnecessary, yet fatigue is becoming more important in structural design.

Hydraulics used to be taught from the empirical standpoint. Between the two wars there was pressure, emanating from the aeronautics field, for instruction in fluid mechanics. Some schools dealt sincerely with this proposed change; but many others simply changed the course name from hydraulics to fluid mechanics.

While in chemical engineering thermodynamics has been taught with regard to interaction between the thermal and chemical circumstances involved, there has been little attention given to such mat-

ters in mechanical engineering. Today, a chemical engineer is not infrequently better trained for fundamental work in heat power than the mechanical engineer, in whose field heat power lies.

During the past several decades the instruction relating to engineering materials has developed into a program reciting a general discussion of their manufacture, and their mechanical properties as revealed by standard acceptance tests. The metallurgical aspects are lightly touched upon if at all. Instances can be found of the absence of a course in materials in electrical engineering, while in other cases in the same field students get the notion that such instruction together with the mechanics of materials is largely unnecessary for an electrical engineer, especially in communications.

Factors of Major Significance in Curriculum Design

Many perplexing problems stem from the fact that the engineering college, in preparing students for professional work that will reach maximum culmination twenty or more years hence, must evaluate hazily discernable future events. It certainly appears desirable that a major stress be placed upon those elements of the curriculum that will give the most continuous and lasting support to the graduate's professional life. Apart from the teaching of the professional attitude toward engineering and the instilling of the engineering and scientific method of attack upon problems, there are certain specific features of the curriculum that can be accepted as most essential.

The first of these has to do with courses least likely to obsolesce. While it is necessary to give a certain amount of instruction relating to the present state of the art, it is certain that the present state will change, and hence that time given to such courses is not time devoted to a subject of sustaining value. Sifting back through the curriculum, it seems clear that instruction in the basic sciences, if taught in a manner such that knowledge of them makes available working tools, contributes the most sustaining part of the curriculum. Among these basic sciences, the greatest potential for future development in science and technology is to be found in mathematics. An engineer with a good knowledge of mathematics is in a position to read with understanding and profit in physics and chemistry. Likewise, as his interest and need may expand, he may read further in the applied sciences, such as mechanics, elastic stability, advanced thermodynamics or fluid mechanics. Similarly, new applications of sciences to engineering situations may be understood and assimilated. Thus, mathematics not only becomes the support of the group of courses that will obsolesce least; it becomes the means of further technical growth as befits the graduate's interest and need. Building into the program in this and other means for further technical self-development of the individual after graduation is the second most important feature of a well-designed curriculum.

The third feature that impresses your committee as of ranking importance has to do with the way in which the applied courses are related to those in basic and applied science. Two distinct approaches are discernible in present practices: one utilizes the engineering situations provided in the applied courses to illustrate the manner of employing the sciences in engineering work, while the other makes the applied courses the goal of the curriculum with the minimum of application of the sciences. The former builds into the student a power of analysis and resolution in engineering situations that permits a wide range of application. The latter tends toward the achievement of a series of skills intended to equip the student for specific jobs immediately upon, and soon after, graduation. The first is professional preparation, the second vocational training. What is involved is not alone the way in which individual courses are presented; it especially relates to the prevailing concept of the function of the whole curriculum.

Following the concept that the differentiating characteristic of the engineering function is the ability to utilize the sciences for the creative process of design and development of useful apparatus, structures or other works, the program should aim at the development and expansion of the imaginative process of creative thought. Engineering educational processes are most commonly of the problem type, requiring but a single answer, with no latitude for judgment, and no imaginativeness beyond the visualization of the circumstance of the problem. Programs in architecture far surpass those in engineering in this respect. We tend toward producing a literal-mindedness that is not compatible with creative imagination.

The foregoing discussion has been in broad terms. It is believed that quantitative specifications for engineering curricula are not adequate as guides to curriculum planning because they tend toward regimentation, toward fixation, and toward eventual stagnation of awareness of the professional needs. The content in each of the five categories enumerated above must be determined in terms of the need of the graduate two or three decades ahead, not in specific detail but in sound skeletal preparation, with most of the details to be filled in through further study and acquisition of experience in the field. The skeletal program must be strong and of sufficient stature to support and sustain the growing professional career.

Engineering is both a science and an art. A balance between both is desirable. The tendency has been to emphasize the art unduly. The "engineering approach" can be presented in the manner in which science is brought to bear on an engineering situation. Much of the art can better be acquired in the field. Industry is coming quite generally to recognize this arrangement as desirable for its needs.

Suggested Program

The quality of engineering curricula varies over a wide range, from highly developed professional programs to those having a predominantly vocational content. The foregoing discussion relates especially to the middle and lower portion of the range. Accrediting procedures relate almost entirely to the minimum standards, and tend to breed complacency among those schools that just barely satisfy such a standard. While accrediting must be maintained as a part of the licensing procedure, it cannot be expected that accrediting of itself will achieve the improvement of schools that satisfy the minimum requirements—unless two or more classes of schools were established and accrediting set up for each class. Your committee believes that such a scheme would neither be welcome nor desirable. Rather it believes

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RULES GOVERNING AWARD OF INSTITUTE PRIZES

THE SIR JOHN KENNEDY MEDAL

A medal, called the "Sir John Kennedy Medal," was established in 1927, to be awarded under the following rules in commemoration of the great services rendered to the development of Canada, to engineering science and to the profession by the late Sir John Kennedy, past-president of The Engineering Institute of Canada.

(1) The medal shall be awarded by the council of the Institute, at intervals of not less than two years, but only when the occasion warrants, as a recognition of outstanding merit in the profession or of noteworthy contributions to the science of engineering or to the benefit of the Institute.

(2) As a guide in making the award, the council of the Institute shall take into consideration the life, activities and standing in the community and profession of the late Sir John Kennedy.

(3) Awards shall be limited to corporate members.

(4) At the beginning of the year of award, all members of Council shall be asked for their recommendations, supported by reasons, for the award of the medal, which must be submitted to council not later than May first. The council of the Institute shall then give consideration to the recommendations, but will not necessarily adopt any of them. If, in the opinion of the council, no corporate member of the Institute thus recommended is of sufficient merit or distinction, no award shall be made.

(5) The award shall be decided by letter ballot of the council in a form to be prescribed by the council. The ballot shall be mailed to each member of the council and shall state the date of the council meeting at which it is proposed to canvass the ballot, which shall not be less than twenty days after the issue of the ballot. Unless at least twenty-five votes are cast there shall be no award. There shall be no award if more than two negative votes are cast.

(6) Announcement of an award shall be made in *The Engineering Journal* and at the annual meeting, and, if possible, the presentation shall take place at that meeting.

THE JULIAN C. SMITH MEDAL

This medal was founded in 1939 by a group of senior members to perpetuate the name of the late past-president of the Institute. It is awarded for "achievement in the development of Canada." The inaugural awards—eleven in number — were made in 1940 and 1941, but subsequent awards are limited to not more than two each year.

The general secretary shall ask each past-president and each vice-president of the Institute for nominations, which shall be submitted to a committee of three consisting of the president and two members of Council appointed by him. This committee may select not more than two names from the nominations, which name or names shall be submitted by open letter ballot to all councillors not later than October first of each year. At least twenty days shall elapse before the ballot is closed. Unless at least twenty-five votes are cast there shall be no award. There shall be no award if more than two negative votes are cast.

It is possible that some special occasion — a centenary celebration or the like—may arise when it would evidently be desirable to award more than two Julian C. Smith medals. In such a case departure from the prescribed limit may be permitted, but only if authorized by a formal resolution of Council, stating the special reasons for the action.

DUGGAN MEDAL AND PRIZE

A prize of a medal and cash to a combined value of approximately one hundred dollars was established in 1935, to be given each year from the proceeds of a donation by Past-President G. H. Duggan, D.SC., LL.D., M.E.I.C., for the purpose of encouraging the development of the branches of engineering in which he practised.

The prize will be awarded for the best paper presented to the Institute in accordance with the following rules:

(1) Competition shall be open to all members of the Institute.

(2) The papers shall be presented to the Institute either at the regular meeting of a branch or at a professional meeting of the Institute, or directly to Headquarters. They shall not have been presented previously to any other body or meeting.

(3) Papers to be eligible for this competition shall deal with subjects concerning the use of metals for structural or mechanical purposes. Without limiting the generality of the foregoing, it is suggested that the following topics come within this category, viz.: the economic and theoretical elements of design, fabrication, machining, transporting, erecting, the investigation of problems or failures, methods of overcoming difficulties, new methods of design or manufacturing, the recording of tests, and other features that add to engineering knowledge.

(4) Papers shall be the bona fide production of the author and proper credit shall be given for any assistance received from other parties, partners or reports. The relation of the author to the work shall be clearly stated. Papers shall be compiled and arranged with proper regard to literary value and shall constitute worthy contributions to the records of the engineering profession.

In judging the competition consideration will be given to the personal knowledge and appreciation of the problems and processes involved and the joint application of theoretical and practical considerations to the execution of the subject which are displayed on the part of the author.

(5) The papers shall be judged by a committee of three corporate members, eminent in the corresponding branch of the profession, appointed for the purpose by council as required.

(6) The award shall be made only when a paper of sufficient merit is presented. The prize year shall be from July 1st to June 30th and papers must be presented to Headquarters of the Institute by the 30th day of June.

(7) The prize shall be awarded at the annual meeting.

THE GZOWSKI MEDAL

A gold medal, called "The Gzowski Medal," is provided from the fund established in 1889 by Col. Sir Casimir Gzowski, A.D.C., K.C.M.G., late past-president of the Institute, and will be awarded according to the following rules for papers presented to the Institute:

(1) Competition for the medal shall be open only to those who belong to the Institute.

(2) The award of medals shall not be made oftener than once a year, the medal year shall be the year ended June last previous to the annual meeting at which the award is to be made.

(3) The papers entered for competition shall be judged by a committee of five, to be called the Gzowski Medal Committee, which shall be appointed by the council as soon after the annual meeting of the Institute as practicable. Members and Honorary Members only shall be eligible to act on this committee.

(4) Papers to be eligible for competition must be the bona fide production of those who contribute them, and must not have been previously made public, nor contributed to any other society in whole or in part.

(5) The medal shall be awarded for the best paper of the medal year, provided such paper shall be adjudged of sufficient merit as *a contribution to the literature of the profession* but not otherwise.

(6) In the event of the committee not considering a paper in any one year of sufficient merit, no award shall be made; but in the following year or years, it shall be in the power of the committee to award the accumulated medals to the authors of different papers which may be deemed of sufficient merit.

(7) The medal shall be suitably engraved by the Institute, and shall be handed to the successful authors at the annual meeting, or be given to them as soon afterwards as possible.

THE LEONARD MEDAL

A gold medal, called "The Leonard Medal," is provided from the annual proceeds of a fund established in 1917 by the late Lieut.-Col. R. W. Leonard, and will be awarded in accordance with the following rules for *papers on mining subjects* presented either to The Canadian Institute of Mining and Metallurgy or to The Engineering Institute of Canada.

(1) Competition for the medal shall be open to those who belong to The Canadian Institute of Mining and Metallurgy or to The Engineering Institute of Canada.

(2) Awards shall be made not oftener than once a year, and the medal year shall be the year ended June last previous to the year in which the award is made.

(3) The medal shall be presented at annual meetings of The Engineering Institute of Canada.

(4) A committee of five shall judge the papers entered for competition, all of whom shall be members both of The Canadian Institute of Mining and Metallurgy and The Engineering Institute of Canada, this committee to be appointed by the council of The Engineering Institute of Canada.

(5) All papers presented shall be the work of the author or authors and must not have been previously made public, except as part of the literature of The Canadian Institute of Mining and Metallurgy or The Engineering Institute of Canada.

(6) Should the committee not consider the papers presented in any one year of sufficient merit, no award shall be made, but in the following year, or years, the committee shall have power to award the accumulated medals or to award a second prize in the nature of a silver medal, or a third prize of books to be selected by the committee.

(7) The medal shall be suitably engraved, containing the name of The Engineering Institute of Canada, and the words, "The Leonard Medal," together with the adopted design, and on the reverse side the name of the recipient, the date and any other inscription that may be decided upon by the committee.

THE PLUMMER MEDAL

A gold medal, called "The Plummer Medal," is provided from the annual proceeds of a fund established in 1917 by J. H. Plummer, D.C.L., and will be awarded according to the following rules for *papers on chemical and metallurgical subjects* presented to the Institute.

(1) Competition for the medal shall be open to those who belong to The Engineering Institute of Canada, and to non-members if their papers have been contributed to the Institute and presented at an Institute or Branch meeting.

(2) Award shall be made not oftener than once a year, and the medal year shall be the year ended June last previous to the year in which the award is made.

(3) The medal shall be presented at annual meetings of The Engineering Institute of Canada.

(4) A committee of five shall judge the papers entered for competition, all of whom shall be members of The Engineering Institute of Canada, and shall be appointed by the council of the Institute.

(5) All papers presented shall be the work of the author or authors and must not have previously been made public, except as part of the literature of The Engineering Institute of Canada.

(6) Should the committee not consider the papers presented in any one year of sufficient merit, no award shall be made, but in the following year, or years, the committee shall have the power to award the accumulated medals or to award a second prize in the nature of a silver medal, or a third prize of books to be selected by the committee.

(7) The medal shall be suitably engraved, containing the name of The Engineering Institute of Canada, and the words, "The Plummer Medal," together with the adopted design, and on the reverse side the name of the recipient, the date and any other inscription that may be decided upon by the committee.

THE T. C. KEEFER MEDAL

This medal was established by Council in 1942 to perpetuate the name of the first president of the Institute.

It is awarded for papers presented to the Institute during the year on *civil engineering subjects*, "civil" being used in the limited sense to indicate structural, surveying and construction work generally.

THE R. A. ROSS MEDAL

This medal was established by Council in 1942 to perpetuate the name of a past president of the Institute distinguished for work in the electrical branch of engineering.

It is awarded for papers presented to the Institute during the year on *electrical engineering subjects*.

THE CANADIAN LUMBERMEN'S ASSOCIATION PRIZE

A prize of $100.00 will be awarded by The Canadian Lumbermen's Association for the best paper presented in any year on the use of lumber or timber in construction; or on the use of wood, including wood waste, in the manufacture of useful products; or on the development of methods of treating wood to make it more resistive to destruction from decay, insects, marine organisms or fire; or in such other related subjects in wood utilization as may later be designed.

The following rules shall govern in the competition:

(1) The competition shall be open to all members of the Institute and to any bona fide resident of Canada.

(2) An award shall be made only if, in the opinion of the examiners, a paper has been presented for publication in the *Journal* of the Engineering Institute of Canada and/or in *Timber of Canada* of sufficient merit to justify the award.

(3) The award shall not be made oftener than once a year, and the prize year shall be from July 1st to June 30th.

(4) The award shall be made at the Annual Meeting of the Engineering Institute of Canada.

(5) A committee of five shall judge the papers entered for competition, all of whom shall be members of the Engineering Institute of Canada.

(6) All papers presented shall be the work of the author or authors and must not have been previously made public except as part of the literature of the Engineering Institute of Canada, or of the Canadian Lumbermen's Association. Proper credit shall be given in the papers for any assistance obtained from other parties or from other reports.

(7) Should the Committee not consider the papers presented in any one year of sufficient merit to justify a prize, no award shall be made, but in the following year or years the Committee shall have power to award accumulated prizes if papers of sufficient merit to justify prizes are presented.

(8) In the case of two or more authors presenting a paper, the amount of the prize shall be divided equally among such authors.

(9) For the first year the award shall be made for the best paper on the structural application of timber and/or plywood as for example—

(1) Laminated structural wood members.

(2) Composite wood and plywood structural members.

(3) New ideas in the design of structural timber units.

Special consideration will be given to papers dealing with the application of low grade material to structural uses. (Approved by E.I.C. Council, June, 1944.)

PRIZES TO STUDENTS AND JUNIORS

(1) Five prizes may be awarded annually for the best papers presented by Students or Juniors of the Institute in the vice-presidential zones of the Institute, as follows:—

The H. N. Ruttan Prize,—
in Zone A—The four western provinces.

The John Galbraith Prize,—
in Zone B—The Province of Ontario.

The Phelps Johnson Prize,—
for an English Student or Junior in Zone C—The province of Quebec.

The Ernest Marceau Prize,—
for a French Student or Junior in Zone C—The province of Quebec.

The Martin Murphy Prize,—
in Zone D—The Maritime provinces.

(2) Awards shall only be made if, in the opinion of the examiners for a zone, a paper of sufficient merit has been presented to a branch in that particular zone.

(3) The winner of a prize shall be required to specify such technical books or instruments as he may desire to the total value of approximately twenty-five dollars when suitably bound and printed or engraved, as the case may be.

(4) The award of prizes shall be for the year ending June thirtieth. On that date, each branch secretary shall forward to the examiners for his

particular zone all papers presented to his branch by Students and Juniors during the prize year, regardless of whether they have been read before the branch or not.

(5) The prizes shall be awarded only to those who are in good standing as Students or Juniors of the Institute on June thirtieth following the presentation of the paper.

(6) The papers must be the bona fide production of those contributing them and must not have been previously made public or contributed to any other society in whole or in part. It is to be understood, however, that a paper which has won or been considered for a branch prize is nevertheless eligible for the Institute Prize. No paper shall be considered for more than one of the five prizes.

(7) The examiners for each zone shall consist of the vice-president of that zone and two councillors resident in the zone, appointed by council. In the case of Zone C, two groups of examiners shall be appointed under the two vice-presidents, one for the English award and one for the French award. The awards shall be reported to the annual meeting of the Institute next following the prize year, and the prizes presented as soon thereafter as is reasonably possible.

PRIZES TO UNIVERSITY STUDENTS

In 1930 Council established eleven cash prizes of twenty-five dollars each for competition among students of Canadian engineering schools, in the year prior to the graduating year. Awards are now made annually to the following institutions:

University of Alberta
University of British Columbia
Ecole Polytechnique, Montreal
Laval University, Quebec
University of Manitoba
McGill University
University of New Brunswick
Nova Scotia Technical College
Queen's University
University of Saskatchewan
University of Toronto

It is the desire of council that the method of their award shall be determined by the appropriate authority in each school or university, so that a prize may be given to the student in any department of engineering who has proved himself most deserving, not only in connection with his college work, but also as judged by his activities in the student engineering organization, if any, or in the local branch of a recognized engineering society.

It is not necessary for the recipient to belong to the Institute, and in this respect the prizes are quite distinct from those offered to Students and Juniors of the Institute, or from the prizes which are offered by a number of our branches to the Students attached to them.

It is felt that the establishment of these prizes not only aids deserving students, but assists in developing their interest in engineering societies' work, and in the resulting acquirement and interchange of professional knowledge. √

REPORT OF COMMITTEE ON ADEQUACY AND STANDARDS OF ENGINEERING EDUCATION

(*Continued from page 505*)

that the engineering education field has a great opportunity to study itself, with the object of finding ways at all levels to improve its service to the profession.

One way to make such a study is to set up an agency that would study and report its findings, as was done by the Society for the Promotion of Engineering Education in the Twenties, under the late W. E. Wickenden.[1] Such a procedure has the effect of isolating the study, and removing it from the schools themselves. The conclusions of Wickenden, written in 1929, are to be found in Appendix I of this report; and your committee is struck with the potency of the statement to today's situation, and the extent of the failure of the schools to implement much of the recommendations. Other statements, appearing since the Wickenden Report and bearing upon the same subject, are given in the remaining appendices.[2] From these it seems clear to your committee that what is now needed is active study and self-appraisal by the schools themselves, looking toward implementation of recommendations already made.

In some quarters the suggestion has been made that an overlay of graduate work is the answer to a need for stronger science content in the curriculum, and to a higher total level of achievement. Your committee believes that the basic program in engineering leading to the first degree in the field should be of a quality to suffice for the professional need of perhaps eighty percent of the graduates, and that truly graduate work should be reserved for the remaining few having special competence. The responsibility for support of the profession, it is believed, must rest chiefly upon the adequacy of the undergraduate program.

The great pressure upon the engineering schools to provide general education in addition to an increased scientific and technical training brings them constantly face to face with the limitation in time imposed by the conventional curriculum. It is perhaps time that this problem was approached in terms of total need; and then the time required to achieve this need be measured beginning with the preparation now available from the secondary schools. For many years the approach has been to see what can be given within the four-year frame-work, with the result of over-crowding the program and with a general shifting first in one direction and then another without total gain in achievement. Other professions have had to face this issue. If engineering maintains professional stature, it will have to organize accordingly. Some have suggested a pre-engineering period in which the high school preparation may, if necessary, be augmented to a desired level before beginning engineering study.

There has been some discussion of the list of degrees granted in engineering. There is a gradual tendency to drop the professional degrees of C.E., M.E., etc., awarded after a suitable interval of practical experience and the submission of an acceptable thesis. If the professional degrees became generally available for work in course, they could then be used to designate the longer programs that are now under way, whether they be one-degree or two-degree programs.

Finally, it becomes clear that there is going to be a shortage of engineers for many years to come. As such a time, in the national interest, it is of paramount importance that the best possible education in engineering be provided by our schools. Each man is going to be called upon to cover a greater range than heretofore, if the engineering needs are to be met. Every school should devote itself to ways of substantial improvement of its program, to the end that its graduates will meet the responsibilities being placed upon them. √

1. *The American Scene,* by W. E. Wickenden, Director, Investigation of Engineering Education, SPEE, vol 1 (1929), p. 1000.
2. (*a*) *Engineering and Social Progress,* by Karl T. Compton, Proceedings SPEE, vol. XLVII (1939), p. 8.
(*b*) *Atomic Engineering?,* by Theodore von Karman, Mechanical Engineering, October, 1945, p. 672.
(*c*) *Tomorrow's Engineers,* by J. R. Van Pelt, Excerpt from Proceedings, ASEE, vol. 55 (1948), p. 168.
(*d*) *Present-day Engineering and Applied Science;* Report of Panel on the McKay Bequest, Harvard University (1950), p. 7.

FROM MONTH TO MONTH

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

Misleading

Every now and then there is a noticeable example of how a group of words can be changed in meaning simply by taking them out of their context. From the Institute's point of view the most important case of this kind occurred during the president's recent visit to the western branches.

At Regina he was interviewed by a newspaper reporter. The questions and answers covered a great range of subjects and had a wide geographical application. Naturally the scarcity of engineers came into the conversation, and the president was asked what he thought of the high wages paid young engineers upon graduation. His reply was to the effect that everyone appreciated that a young graduate who had had no experience was not able immediately to give full value for his salary, but that he would acquire experience quickly, and so within a short time would be worth what he was getting, and more. From that point he would advance steadily until eventually he was likely to be running the business.

What the president was trying to say was that today's employers were buying potential. They were more interested in the young man's prospects for development than in his immediate "cash surrender value".

Imagine the surprise and consternation that followed the radio and press reference to the interview when it appeared under the heading — "Graduate Engineers Not Worth Salaries", and the item of only ten lines in length quoted the president as saying "Engineers just out of college today are not worth their salaries".

It is doubtful if any news about the Institute ever had such wide distribution. Apparently every paper in the country ran this item and every engineer saw it. Headquarters received a quite impressive reaction, to put it mildly. It was evident immediately that something was wrong because the president throughout his lifetime has been a constant advocate of better salaries for engineers.

A long distance telephone call to the president at Saskatoon brought out the facts. It was hoped that the item would not be read too widely, and that it would blow over without upsetting too many. What a hope!

It became apparent that some attempt should be made to catch up to or overtake the misleading reference. It is well known that a correction never does catch up, but a try had to be made. After a further telephone talk with the president and on the authority of Council, telegrams were sent to every university and a statement was issued by vice-president Stirling on Council's instructions. The statement reads as follows:

"J. B. Stirling, vice-president and president-elect of the Engineering Institute of Canada, has stated that recent newspaper and radio references to an interview with President Ira P. Macnab are misleading. Dr. Macnab was reported as saying that salaries paid engineers upon graduation were too high. The Council of the Institute at its regular monthly meeting in Montreal on April 24th, after telephone conversations with the president, agreed that a statement should be issued so that the correct information would be available to its members and the public.

"The facts are that the Institute and Dr. Macnab do not believe present salaries are too high, but in many instances are too low. For over fifty years the Institute has advocated and worked for adequate salaries for the profession and feels that this objective is still far from attainment in many fields.

"Despite the shortage of engineers, today's starting salaries for graduates are no higher in purchasing value than they have been for many years. The Institute expects they will go higher in the future.

Cover Picture

The cover picture illustrates the Cement Industries Hall at Zurich, Switzerland, constructed for the Swiss National Exposition in 1939. This was the work of the late Robert Maillart. — *Photo courtesy Museum of Modern Art, New York.*

"This year's graduating classes (if no one fails in his examinations) will total only 1,750, and in three years' time will be only 1,000. The National Employment Service reports definite known openings for over 2,350 graduates. The Institute believes the demand is even greater than this and that consequently starting salaries are certain to be increased beyond to-day's figure.

"Mr. Stirling reports that the Council of the Institute regrets extremely that Dr. Macnab's remarks separated from their context should have been so completely misleading."

The statement is reprinted in the *Journal* in case some members did not see it referred to in the press. It is important that members should realize that the president of the Institute under any circumstances would not make such a statement. The great number of engineers who know the president would realize at once when they heard or saw the reference, that something was surely wrong. Judging by the number who communicated with Headquarters, there are a lot who do not know him.

Is it too much to hope that with the wide distribution of Council's statement, the misleading story has been overtaken ?

Expanding with Canada

The month of April saw three more branches added to the Institute family, bringing the total to 41. This time it was Ontario that jumped ahead, giving that province 18 branches.

The president visited the three new branches just ahead of his tour of Zone A, which finished in Vancouver on May 1st. The first stop was at Port Hope where the inaugural meeting was held on Monday, April 17. There were 42 members present including representatives from the parent branch, Peterborough, as well as Belleville and Toronto. The provisional chairman is W. S. Raynor to whom the charter was presented and the secretary-treasurer is J. L. Sylvester.

On Tuesday the president, accompanied by Mrs. Macnab and the general secretary, motored to Hamilton, where they met with the branch executive in the afternoon and dined with a group of about 20 of the "old timers" that evening. This was the Macnabs' first presidential visit to Hamilton.

On Wednesday morning the group arrived at North Bay. That evening there was an excellent dinner attended by the ladies as well as the men to the number of 49, including 30 from Temiskaming. Later in the evening while the ladies played bridge the men held a business meeting. Provisional officers elected were G. L. Hood, chairman and D. Keith Campbell, secretary-treasurer.

The charter night for this branch is to be held in the Fall at Temiskaming. President-elect Stirling has arranged already to be there. The "Temiskamites" promise a good show.

Mr. Russ Eaton, councillor for Sudbury, was on hand to represent the parent branch. As an added duty he motored the party from North Bay to Iroquois Falls for the inauguration of the new Northeastern Ontario Branch. The trip started in beautiful Spring weather and finished in a blizzard, the turning point being about Haileybury. The last hundred miles was quite an experience, but good driving, both from the front seat and the back seat, brought the party through in time and without mishap except for the loss of Mrs. Macnab's hat in a gale of wind.

The branch meeting was held in the Iroquois Falls Hotel with 71 present, including representatives from Kapuskasing and Cochrane.

North Bay-Temiskaming Branch

Upper left. At Iroquois Falls, left to right: Mrs. C. Hellstrom, Temiskaming; G. L. Hood, chairman of the Branch, and Mrs. Hood; and Mr. and Mrs. B. Gray, of Temiskaming.

Lower left. From left to right: Mrs. J. Cooper; President I. P. Macnab; J. S. Cooper, North Bay; Mrs. Macnab; Russ Eaton of Sudbury; and Mrs. P. Climo of Temiskaming.

Below. Left to right: R. G. Dye, Mr. and Mrs. A. Booy, Mr. and Mrs. H. Harkness, Mr. and Mrs. D. Day, R. O'Grady, and J. Chandler, all of Temiskaming.

North Eastern Ontario Branch

Above. At Iroquois Falls, President Macnab presented the charter of the new Branch to F. W. Whitely.

Top right. At left side of table, from foreground: R. D. Ross, Miss Ann Goodfellow, W. J. Hollingsworth, and Miss Mary Graham. Right side, from the foreground: Miss Pauline McKinnon, A. S. Millar and Mrs. Millar, C. R. Newton and Mrs. Newton, and Mr. and Mrs. S. Nowak.

Second right. Left to right: G. M. Lyon, vice-chairman; R. A. Carter and F. B. Whitely, committee members; I. M. Foster, chairman; J. Sylvester, secretary-treasurer; and A. S. Millar and W. B. Jackson, committee members.

Port Hope Branch

Upper right. Left to right: W. S. Raynor, chairman of Port Hope Branch; J. G. G. Kerry, honorary chairman, and Mrs. Kerry; Mrs. W. H. Paterson; S. Sillitoe, of the Belleville Branch.

Lower right. Left to right around the table: J. L. Sylvester, secretary-treasurer; R. L. Dobbin, of Peterborough; E. G. Gurnett, chairman, Belleville Branch; Mrs. D. A. Drynan; D. A. Drynan, chairman, Peterborough Branch; and Mrs. J. L. Sylvester.

Below. President I. P. Macnab presented the charter of the new Branch to Chairman W. S. Raynor.

At Hamilton

In between inaugurations the president was able to spend a few hours in Hamilton to meet with the executive.

Upper right. Left to right: G. L. Schneider, A. W. S. Tite, Eric G. Jorgensen, E. T. W. Bailey, and H. A. Cooch.

Lower right. Left to right: E. P. Muntz, E. H. Darling, C. H. Hutton, and F. Paulin.

Below. Left to right: J. A. Reid, I. P. Macnab, W. L. Hutchison, W. A. Dawson.

First A.S.M.E. Boiler Code Committee Meeting in Canada

During the week of April 21st, there assembled at the Royal York Hotel in Toronto a gathering which was unique in many ways.

Under the sponsorship of the International Council of the American Society of Mechanical Engineers and The Engineering Institute of Canada, the first meeting ever to be held in Canada, of the A.S.M.E. Boiler Code Committee became a matter of historic record.

This Committee whose responsibility it is to establish and maintain the engineering standards applying to the manufacture and installation of items of mechanical equipment in the United States which are subject to fluid pressure, held all of its meetings in New York City for many years. A few years ago, the practice was inaugurated of holding one meeting in each year, outside New York City. At the summer meeting of the American Society of Mechanical Engineers held jointly with The Engineering Institute of Canada in Toronto last June, plans were laid for holding the 1952 out-of-town meeting of the Boiler Code Committee in Canada.

The International Council of these two engineering organizations was created some years previously to deal with matters of mutual interest to mechanical engineers in our two countries and the offices of chairman and secretary are alternated from year to year between the two societies. This year it so happened that the chairman was Dr. O. W. Ellis, M.E.I.C., of the Ontario Research Foundation in Toronto and Dr. L. Austin Wright, M.E.I.C., general secretary of The Engineering Institute was secretary. In view of this, the detailed arrangements for the meeting were carried out by the office of the Institute from Montreal.

It was the expressed wish of the Boiler Code Committee officials that as much time as possible should be made available by the members of their committee for discussion of matters of mutual interest with the representatives of Canadian Companies and other organizations. With this in mind a full day was left free for panel discussions and all interested parties invited to participate.

The Canadian Standards Committee of which W. R. McCaffrey, M.E.I.C., of Ottawa is general manager, being directly concerned with all of the matters under discussion, another full day was set aside for discussions with their B-51 Committee which deals with boilers and pressure vessels. This Committee, incidentally, includes in its membership, the chief boiler inspector of each province as well as certain representatives from the boiler manufacturers and insurance companies.

In order to take advantage of the opportunity afforded by having all of their members together, Mr. Joseph Taylor, chief boiler inspector for the Province of Saskatchewan, who is chairman of the B-51 C.S.A. Committee, called a meeting of his group on the preceding Monday and Tuesday.

Besides the various meetings already referred to, the welding sub-committee and the sub-committee on unfired pressure vessels held meetings prior to the regular

meeting of the main Boiler Code Committee.

The attendance at all meetings was most gratifying and there was a wide representation of Canadians from all parts of the country to take advantage of the opportunity so kindly offered by the A.S.M.E. Boiler Code Committee to meet with its members and to attend its deliberations.

Altogether there were well over 100 who registered and of these 65 were Canadians. Every province but one was represented and practically every large boiler manufacturer and oil refining company had one or more members of their staffs on hand.

To provide opportunities for social intercourse between the members of the Committee and the others in attendance two informal luncheons were held on the Thursday and Friday and on Thursday evening a reception and dinner were arranged at which some 90 guests and their wives were present. Dr. O. W. Ellis, chairman of the International Council, presided on this occasion and other interested bodies were also represented. Messrs. H. B. Oatley and H. E. Aldrich, chairman and vice-chairman respectively of the A.S.M.E. Boiler Code Committee were tendered the thanks of all present for making such a successful series of meetings possible. Mr. J. G. Morrow, president, and Mr. W. R. McCaffrey, general manager, together with Mr. Joseph Taylor, chairman of the B-51 Committee were present on behalf of the Canadian Standards Association. The Canadian Institute of Power Engineers was represented by Mr. Emmett Briceland, national vice-president and Mr. C. H. Watkins, vice-president, Toronto. The Canadian Steel Boiler Institute was represented by its secretary-manager, Mr. J. F. Crowder of Toronto.

Corporation Officials Visit Sherbrooke

Dr. Adrien Pouliot, Dean of Engineering at Laval University and President of the Corporation of Professional Engineers, and Mr. Léo Nadeau, General Secretary of the Corporation, met with the members of the Engineering Institute of Canada Branch at Sherbrooke, Quebec, on March 17th. In the above photograph the officers and executive committee of the branch are seen with the officers of the Corporation. They are as follows:—

First row, from left to right: Mr. J. C. Critchley; Mr. G. M. Dick, chairman; Dr. Adrien Pouliot, Dean, Laval University, Guest Speaker; Mr. A. C. Crépeau, vice-chairman; Mr. L. Nadeau, General Secretary, Corporation of Professional Engineers.

Second row, from left to right: Mr. R. H. Blackmore, Secretary; Mr. Gaston Masse; Mr. Bruce Bradley; Mr. L. Georges Carignan, Treasurer; Mr. T. W. Houghton; Mr. D. K. Sherry.

A New Type Face

This short item is set in a new type face which has been selected for the Technical Section of the *Journal*.

The type is known as 10-point 36 Scotch Roman, and it is recognized by type experts as being one of the most readable of all faces.

This type is used in the following papers in this issue and will be the new standard: Precast Reinforced Concrete Building Frames; Maintenance Testing of Electrical Apparatus; The Opposed-Piston Diesel Engine.

The change will be gradual, as a number of technical papers for forthcoming issues are already in type form. However, by June, or July at the latest, it is anticipated that all technical papers will be presented in this new type.

Readers' comments on the new type face and recommendations for further improvement in the appearance of the *Journal* will be welcome by the editor and the Publication Committee.

Correspondence

Dear Mr. Editor:

Engineers contemplating employment outside Canada are faced by two important questions: what is the cost of living abroad, and what are living conditions there? The Department of External Affairs is able to provide information on these and similar questions.

To obtain this information, the enquirer only needs to write to the Department of External Affairs, Ottawa, or to the Canadian representative in the country concerned. In either case, he will receive comprehensive and accurate information.

I would appreciate it if you would publish this letter in *The Engineering Journal* for the benefit of the members.

The employment section of the Institute might consider notifying applicants for positions abroad that the Department of External Affairs provides this valuable service.

Erling Hesla, Jr.E.I.C.,

Co. Cobast,
Sao Paulo, Brazil.

Elections and Transfers

At the meeting of Council held at Headquarters on Thursday, April 24th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

A. M. Dufresne, *Montreal.*
H. J. Hawkins, *Toronto.*
R. F. Hawkins, *Toronto.*
J. E. Hayes, *Montreal.*
J. R. B. Jones, *Ottawa.*
H. Kullango, *Hamilton.*
M. G. Lanouette, *Rimouski.*
C. C. S. LeClair, *Toronto.*
P. J. Lusser, *Montreal.*
W. Michalski, *Birmingham, Eng.*
T. E. Molyneux, *Ottawa.*
A. G. Moreton, *Sarnia.*
N. R. Spencer, *Herts, Eng.*
C. F. Taylor, *Bathurst.*
R. F. Tully, *Ottawa.*
E. F. Walker, *Halifax.*
H. A. Young, *Ottawa.*

Juniors:

R. J. Austin, *Toronto.*
J. P. Bergevin, *Shawinigan.*
M. E. Callin, *Montreal.*
R. G. Christie, *Niagara Falls.*
R. H. Darke, *Hamilton.*
R. Guertin, *Montreal.*
A. W. Kielback, *Arvida.*
D. C. Lempriere, *Toronto.*
R. L. Francis, *Lethbridge.*
D. A. McCammon, *Toronto.*
J. R. Palmer, *Ottawa.*
A. Ryttel, *Montreal.*
R. A. Sara, *Toronto.*
G. S. Walker, *Montreal.*
J. R. A. Walker, *Arvida.*

Transferred from the class of Junior to that of Member:

D. Beattie, *Georgetown.*
J. Brown, *Windsor.*
G. M. Burns, *London.*
R. M. Dillon, *London.*
H. D. Forbes, *Kingston.*
R. A. Grosskurth, *Halifax.*
D. M. Gunn, *London.*
G. A. Hutton, *Calgary.*
W. B. Jackson, *Cochrane.*
D. D. Love, *Fort Garry.*

Transferred from the class of Student to that of Junior:

J. P. Miller, *Rainy River.*
A. F. Roberts, *Vancouver.*

The following Students were admitted:

Royal Military College

A. R. Black
C. J. Burry
R. F. Day
F. N. D. Gilbert
P. E. Hall
T. D. McGreer
A. Pickering
P. A. Preville
R. V. A. Roe
F. E. Ross
J. Tetreault
W. N. Wray
J. R. Wright
W. Zatychec

University of Toronto

M. G. Capes
H. H. Greenly
W. R. Hammond
R. C. McDermott
K. E. Walters
R. N. Williamson

University of Alberta

F. F. Bollefer
J. Fedorowich
W. Fedunec
H. M. McCollister
P. M. G. Nettleton

Nova Scotia Technical College

H. A. Cottenden
J. T. Wells

University of Manitoba

M. N. Anderson
J. Huebert

Lakehead Technical Institute

H. E. Tuisku

Queen's University

D. A. Cays
D. O. Monson
G. W. Vosper

Applications Through Associations

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

ALBERTA

Member:

J. C. Moon.

Junior to Member:

A. A. Kenwood.
G. M. Kernahan.
A. S. McLatchie.
R. D. Rosser.
G. W. Sadler.
J. E. Staples.
R. S. Trussler.

SASKATCHEWAN

Members:

J. I. Mallow.
W. T. McGinn.

Junior:

D. R. Francis.

Students:

B. Pant.
L. E. Davies.
H. R. Hyslop.
B. Lavrinoff.
E. D. McBride.

Junior to Member:

D. G. M. Mollard.

Student to Junior:

S. J. Warder.

NOVA SCOTIA

Junior to Member:

J. R. Fiske.

QUEBEC

Junior:

E. B. Lee.

Canada Grows

Recently the Financial Post published a list of construction contracts "under way or recently completed". As a means of grasping some idea of Canada's tremendous development, a perusal of this list is helpful. It is reprinted herewith, with the permission of the publishers:

The Industry's Big Jobs

From Newfoundland to B.C., millions are being poured into major construction contracts. Here's a special Post survey on the big ones, under way or recently completed:

Over $10 Millions

Alberta Pulp Mills, pulp mill at Red Deer, Alta., $20 millions.

Aluminum Company of Canada Ltd., giant aluminum project at Kitimat, B.C., $350 millions.

Brompton Pulp & Paper Co., expansion program at Red Rock, Ont., $15 millions. Includes housing.

Canada Cement Co., cement plant addition at Exshaw, Alta., $7 millions.

Canadian Chemical Co., petrochemical and cellulose acetate plant at Edmonton, $50 millions.

Canadian Industries Ltd., nylon salts plant at Maitland, Ont., $30 millions.

Canadian Industries Ltd., polyethylene flake plant at Edmonton, more than $10 millions.

Canadian Johns-Manville, new mill at Jeffery Mine at Asbestos, Que., $14 millions.

Canadian Oil Refineries Ltd., oil refinery at Froomfield, Ont., $17 millions.

Celgar Development Co., integrated lumber, newsprint and pulp project in Arrow Lake, district, B.C., $65 millions.

Consolidated Mining & Smelting Co. of Canada, modernization of lead smelter over four or five years, at Trail, B.C., $12 millions.

Dominion Steel & Coal Corp., steel plant at Sydney, N.S., $16 millions.

Elk Falls Co., newsprint mill at Duncan Bay, B.C., $22 millions.

Ford Motor Co. of Canada, new assembly plant at Oakville, Ont., $17 millions.

Howard Smith Mills Ltd., expansion program at Crabtree Mills and Ville LaSalle, Que., $14 millions.

Imperial Oil Co., oil refinery expansion at Sarnia, $15 millions.

Imperial Oil Co., oil refinery expansion and rehabilitation at Ioco, B.C., $13.5 millions.

MacMillan & Bloedel Ltd., pulp mill expansion, at Nanaimo, B.C., $16 millions.

Saint John Sulphite Ltd., expansion program at Union Point, N.B., $20 millions.

Sherritt Gordon Mines Ltd., nickel refinery at Fort Saskatchewan, Alta., $12 millions.

Standard Oil of B.C., oil refinery expansion at Burnaby (Vancouver), B.C., $50 millions.

Western Plywood Co., sulphite pulp mill at Quesnel, B.C., $15 millions for plant.

Over $2-$10 Millions

Alaska Pine & Cellulose Ltd., plant modernization at Port Alice, B.C., $6 millions.

Anaconda American Brass Ltd., additions at Toronto, $4 millions.

Asbestos Corp., mill for Vimy Ridge, Que., mining property, 5,000 tons per day capacity.

Barvue Mines Ltd., 4,000-ton concentrator plant at Barraute Twp. Quebec, property, $6 millions.

B. A. - Shawinigan Ltd., petrochemical plant at Montreal East, $3-4 millions.

Brompton Pulp & Paper Co., modernization and expansion program at East Angus, Que., $7 millions.

Canada Cement Co., cement plant at Havelock, N.B., $8 millions.

Canadian Arsenals Ltd., radar equipment plant at Toronto, $3.5 millions.

Canadian Pratt & Whitney Aircraft Co., aircraft engine plant at Montreal, $7-8 millions.

Canadian Refractories Ltd., fire brick plant, at Marelan, Que., $3.5 millions.

Canada Cement Co., cement plant expansion, at Belleville, Ont., $5 millions.

Canadian Acme Screw & Gear Ltd., plant project at Toronto, $2.5 millions.

Cassiar Asbestos Corp., mill for asbestos property, McDame Lake area, to produce 6,000 tons a year of Group 3 fibre.

Consolidated Mining & Smelting Co. of Canada, phosphate plant at Kimberley, B.C., $9 millions.

Consolidated Mining & Smelting Co. of Canada, zinc plant expansion at Trail, B.C., $3.2 millions.

Canadian Resins & Chemicals Ltd., expansion program at Shawinigan Falls, Que., $3.5 millions.

Canadian Westinghouse Co., expansion of electronics plant at Hamilton, $2.5 millions.

Dominion Tar & Chemical Co., chemical plant in Montreal East, $7 millions.

Dominion Textile Co., modernization program, at Montreal, $3 millions.

Dryden Pulp & Paper Co., expansion program, $3.5 millions.

Electric Reduction Co. of Canada, phosphorus plant at Varennes, Que., $5 millions.

Ford Motor Co. of Canada, powerhouse addition at Windsor, Ont., $6.5 millions.

Frigidaire Products of Canada Ltd., expansion at Toronto, $7.5 millions.

Goodyear Tire & Rubber Co. of Canada, expansion program at New Toronto, Ont., $5 millions.

Imperial Oil, oil refinery program at Edmonton, $5 millions.

Imperial Oil, refinery modernization at Regina, $7 millions.

John Inglis Co., steam turbine engine plant in Scarborough Twp. (Toronto), $6 millions.

Lucas-Rotax Ltd., jet engine fuel systems plant at Toronto, $2.5 millions.

Massey-Harris Co., plant expansion, at Toronto, $2.5 millions.

McColl-Frontenac Oil Co., oil refinery at Winnipeg, $12 millions.

Minnesota Mining & Manufacturing of Canada Ltd., plant near London, Ont., $2.5 millions.

Nichols Chemical Co., sulphuric acid plant at Valleyfield, Que., $2.5 millions.

North American Cyanamid Ltd., chemical plants expansion at Niagara Falls and Welland, Ont., $4 millions.

Polymer Corp., petrochemical plant expansion at Sarnia, $7-$9 millions.

Provincial Paper Ltd., expansion of paper mill at Thorold, Ont.

A. V. Roe Canada Ltd., plant expansion at Malton, Ont., $6-$7 millions.

Sherritt Gordon Mines Ltd., plant relocation program at Lynn Lake, Man., $2.9 millions.

Shawinigan Chemicals Ltd., carbide plant at Varennes, Que., $7 millions.

Shell Oil Co., petrochemical plant in Montreal East, $3 millions.

Shell Oil Co. of Canada, oil refinery, in Montreal East, $3 millions.

Sun Oil Co., refinery at Sarnia, Ont., $10 millions.

United Asbestos Corp., mill for Black Lake, Que., asbestos property, 5,000 tons per day capacity.

$1-$2 Millions

Acme Steel Co. of Canada, steel strapping factory at Toronto, $1 million.

British Columbia Cement Co., expansion program at Bamberton, B.C., $2 millions.

British Columbia Forest Products Ltd., plywood plant at Victoria, B.C. B. C. Contractors Ltd., $2 millions.

British American Oil Co., grease plant at Clarkson, Ont., $1.5 million.

British Columbia Packers Ltd., fish processing plant expansion program, at Canso, N.S., $1.5 million.

Brown Boveri (Canada) Ltd., electrical goods plant at St. Johns, Que., $2 millions.

Bruck Mills Ltd., new spinning division, at Sherbrooke, Que., $1.3 million.

Cabot Carbon of Canada Ltd., carbon black plant at Sarnia, Ont., $2 millions.

Canada Wire & Cable Co., plant expansion at Leaside, Ont., $2 millions.

Canadian Canners Ltd., vegetable canning plant at Morden, Man., $1 million.

Canadian Glassine Co., paper mill at Quebec City, $1 million.

Canadian Industries Ltd., sulphur dioxide plant at Copper Cliff, Ont., $1-$2 millions.

Canadian Industries Ltd., plant expansion and new offices, at New Toronto, Ont., $1 million.

Canadian Steel Improvements Ltd., jet engine parts plant, Etobicoke Twp., (Toronto), $2 millions.

Canadian Tube & Steel Products, plant addition at Montreal, $1.6 million.

Canbri Manufacturing Co., textile plant addition at Ajax, Ont., $1 million.

Christie's Bread Ltd., bread and cake bakery and head office, Dickie Construction, at Toronto, $1.5 million.

Columbia Cellulose Co., at Port Edward, B.C., celanese plant expansion, $2 millions.

Dominion Asbestos Mines mill for St. Adrian, Que., asbestos, property, $1.4 million.

E. B. Eddy Co., plant modernization, at Hull, Que., Foundation Co. of Canada, $1.5 million.

Eldorado Mining & Refining (1944) Ltd., mill for Ace Mine uranium property in northern Saskatchewan, 500 tons per day capacity.

Fairey Aviation Co., Eastern Passage, N.S., Brookfield Construction Co., $1 million.

Manitoba Rolling Mills Co., plant expansion at Selkirk, Man., $1 million.

Rolls-Royce Ltd., aircraft engine assembly plant at Montreal, $1.5 million.

Sault Structural Steel Co., plant at Sault Ste. Marie, Ont., $1.5 million.

St. Maurice Chemicals Ltd., chemicals plant at Varennes, Que., $2 millions.

Thor-Canadian Co., at Toronto, $2 millions.

Westminster Paper Co., expansion program at New Westminster, B.C., $2 millions.

News of Other Societies

J. G. Inglis, Toronto Transportation Commission, was elected president of the Toronto Electric Club for 1952-53, at the 36th annual meeting of the Club on March 19.

A two-day industrial design conference on May 28 and 29, will be presented as part of the annual convention of the **Canadian Manufacturers' Association,** at the Royal York Hotel, in Toronto, Ont.

The 35th annual conference and exhibition of **The Chemical Institute of Canada** (18 Rideau St., Ottawa 2, Ont.) will take place in Montreal, June 2, 3 and 4, at the Mount Royal Hotel.

Resources Minister Robert Winters has announced that the Sixth British Commonwealth Forestry Conference will meet in Ottawa commencing August 11, 1952.

Canada will be represented by delegates from the federal and provincial governments and by associate delegates from the forest industries and the four universities teaching forestry.

The **Canadian Section** of the **American Water Works Association** recently announced its convention in Montreal, May 26-28, at the Mount Royal Hotel.

Information is available about the semi-annual meeting of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) which will take place at the Sheraton-Gibson Hotel, Cincinnati, Ohio, June 15-19, 1952.

Also announced are the meeting, June 23-27, of the Oil and Gas Power Division of A.S.M.E., Hotel Statler, Buffalo, N.Y.; and the meeting, June 19-21, of the Applied Mechanics Division of A.S.M.E., at Pennsylvania State College, State College, Pa.

The 50th anniversary annual meeting of the **American Society for Testing Materials** (1916 Race Street, Philadelphia, Pa.) is scheduled for June 23-27, at the Hotels Statler and New Yorker, New York City.

Personals

News of the Personal Activities of Members of the Institute

W. A. Dawson, M.E.I.C., manager of the Hamilton branch of the F. F. Barber Machinery Division of Massey-Harris Company Limited, has been loaned by his Company to take an appointment as government representative of the gun division of the production branch of the Department of Defence Production at the Sorel and Longueuil gun arsenals.

During part of World War II he was chief planner of Bofors Gun Production at Otis Elevator Company, Hamilton, prior to which assignment he studied gun manufacture during the "Battle of Britain" at a number of outstanding British Ordnance Works. In 1944 he was posted by the Department of Aircraft Production at DeHavilland Aircraft Company Limited, Toronto, as tool controller, which position terminated at the end of the war.

Mr. Dawson was born at Barrie, Ontario, where he received his elementary education, following which he attended Queen's University, graduating in mechanical engineering in 1923. For the next twelve years he was associated with the Ford Motor Company of Canada at Windsor, Ontario, starting as a mechanical draughtsman and advancing to the position of chief tool engineer. Then followed successful appointments with Algoma Steel Corporation, Sault Ste. Marie, Ontario; Chrysler Corporation of Canada Limited, Windsor, Ont.; E. Long Limited, Orillia, Ont.; as superintendent of shops and foundries, plant engineer and plant manager, respectively.

Mr. Dawson is vice-chairman of the Hamilton Branch of the Institute. He is a member of the Association of Professional Engineers of the Province of Ontario. He is also a past national secretary of the American Society of Tool Engineers and the charter chairman of its Hamilton Branch. He is an active director of the General Alumni Association of Queen's University, Kingston.

W. A. Dawson, M.E.I.C.

H. Massue, M.E.I.C., engineer economist with the Shawinigan Water and Power Company, Montreal, has been appointed one of the nine directors for the Crown Company, Atomic Energy of Canada Limited, that will direct Canada's atomic program.

Dr. Massue, a graduate of Ecole Polytechnique, Montreal, and of Massachusetts Institute of Technology, received the honorary degree of doctor applied science from the University of Montreal in 1947.

In 1949 Dr. Massue was elected to serve on the Board of Research and Traffic Problems of Montreal, and in 1950 he was elected a Councillor of the Corporation of Professional Engineers of Quebec.

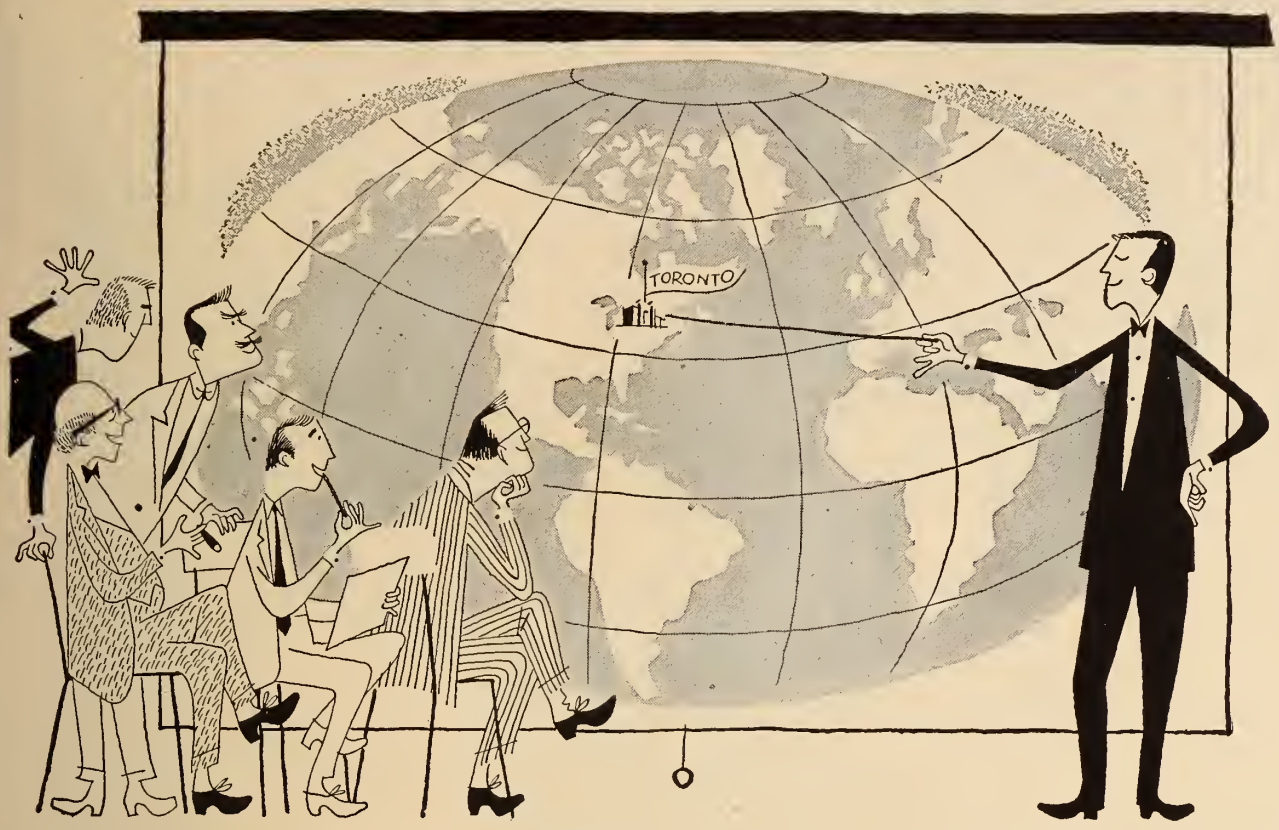
He was a chairman of the Montreal Branch of the Engineering Institute in 1937, and a Councillor for the Montreal Branch in 1939. He has served also on the council of the Montreal Chamber of Commerce.

T. V. Berry, M.E.I.C., was named in February a commissioner of the Greater Vancouver Water District.

Mr. Berry started to work for the City of Vancouver in 1923 after his graduation in applied science from the University of British Columbia. He was made an assistant engineer of the Greater Vancouver Water Board two years later. Subsequently he was for many years, secretary-treasurer of the Vancouver and District Joint Sewerage and Drainage Board. He has been treasurer of the Greater Vancouver Water District for many years.

Mr. Berry was councillor of the Vancouver Branch of the Institute in 1947 and 1948.

Dr. J. Krol, M.E.I.C., assistant professor of mechanical engineering at the University of Manitoba, has been awarded the George Stevenson Prize for his paper on the "Automatic Hydraulic Ram". This is an international award for achievement in the field of engineering offered by the Institution of Mechanical Engineers in Great Britain and



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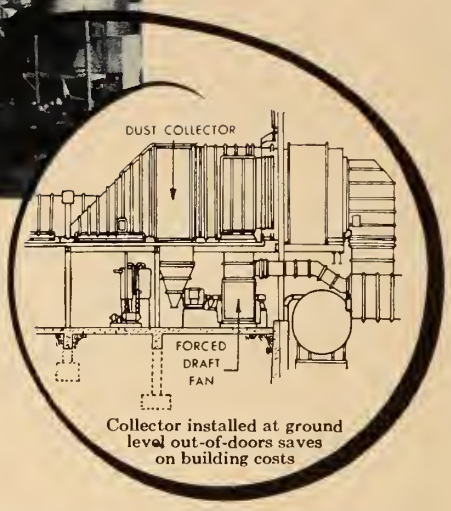

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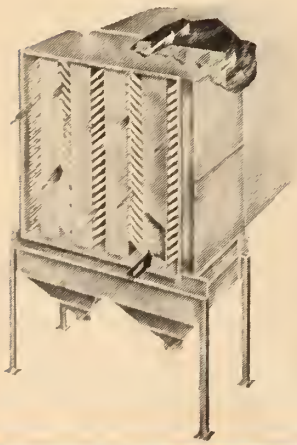

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Dr. Krol who was formerly with the Research Department of Howard Smith Paper Mills Limited teaches machine design and industrial engineering to third and fourth year students. Before receiving his Doctor of Philosophy degree in 1947 from the University of London, he served during the war years on the headquarters staff of the British Ministry of Supply as an executive assistant to the Director of General Ammunition Production.

F. F. Fulton, M.E.I.C., has been appointed assistant to the vice-president in charge of sales, with the Northern Electric Company Limited. In addition to regular duties associated with his new position, Mr. Fulton will be the company representative responsible for negotiating all special contracts with the department of Defence Production in Ottawa, on behalf of all company divisions.

Mr. Fulton studied at Mount Allison University and has been with the Northern Electric Company since his graduation from McGill University with a B.Sc. degree in electrical engineering in 1928. Most of his career has been devoted to the field of electronics, except during the six years he spent with the armed services. He entered the active forces in September, 1939 as a lieutenant and attained the rank of brigadier in 1945. Practically all of his war service was spent overseas, and he was awarded the Order of the British Empire in 1943 for his contributions to the technical services.

Upon his return to Northern Electric, he was made chief engineer of the electronics division, and he was appointed manager of the company's Belleville Plant in 1950; and assistant to the vice-president and managing director of the company in 1951.

W. F. Mainguy, M.E.I.C.

W. F. Mainguy, M.E.I.C., vice-president, distribution, since 1947, has been appointed executive vice-president of the Shawinigan Water and Power Company, Montreal.

Mr. Mainguy graduated from Queen's University in 1928 with honours in electrical engineering and the same year joined the Power Engineering Company which was later merged with the Shawinigan Engineering Company Limited. He transferred to the Shawinigan Water and Power Company in 1932 and was

with the commercial and distribution department, first as power sales engineer and then as power sales manager. He became personnel manager in 1943 and a vice-president four years later.

A. C. Abbott, M.E.I.C.

A. C. Abbott, M.E.I.C., manager of the commercial and distribution department for the past two years has been appointed vice-president, distribution with the Shawinigan Water and Power Company, Montreal.

Mr. Abbott attended Montreal High School and Bishop's College School in Lennoxville and received his B.Sc. degree in electrical engineering at McGill University in 1925. The following year he obtained a degree in electrical engineering with honours after which he joined the Shawinigan organization. He was transferred to the old Beauharnois Electric Company Limited in 1928, with headquarters at Valleyfield, and a year later became superintendent of that company. In 1930 he was appointed distribution engineer at Three Rivers for the newly organized commercial and distribution department of the parent Shawinigan Company and in 1938 became electrical engineer of that department. In 1947 he was appointed assistant manager of the department and in 1950 became manager.

W. J. Dick, M.E.I.C., of Edmonton has been appointed chairman of the Royal Commission on the Bow River Flooding.

W. J. Dick, M.E.I.C.

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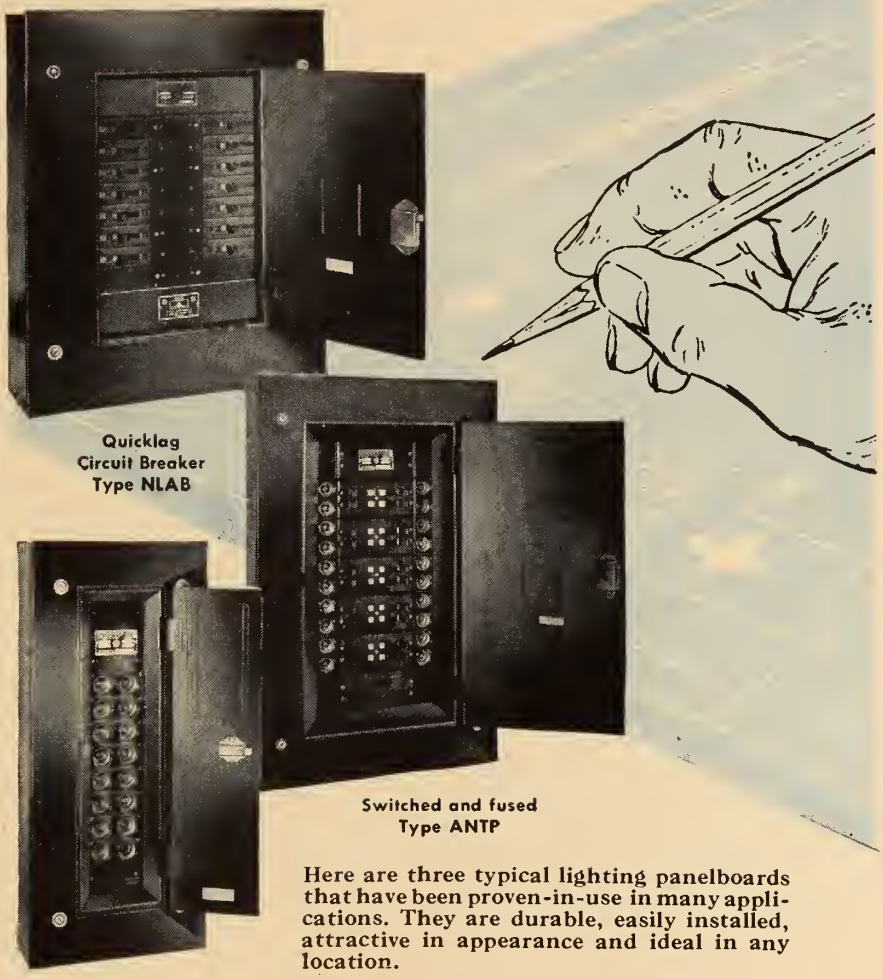

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The purpose of the inquiry is to investigate the causes of the flooding and any conditions aggravating the flood. The Commission will report to the Lieutenant Governor in Council as to what remedies might be adopted to remove or alleviate the danger of flooding in the Bow River Valley and to report what steps might be taken to prevent the resulting damage to buildings and property in that area.

Mr. Dick is a consulting mining engineer and secretary of the Inter-Provincial Committee, Petroleum and National Gas, at Edmonton, Alta.

Foundation Company

F. G. Rutley, M.E.I.C., has recently been elected president and general manager of the Foundation Company of Canada, Limited.

Born in Toronto in 1890, Mr. Rutley graduated from the University of Toronto in 1912 with a B.A.Sc. degree. He worked for a time with the Calgary Power Company and in 1914, joined the staff of the Foundation Company as resident engineer. From 1920 to 1921, he served as a superintendent and from 1922 to 1923, as purchasing agent, subsequently acting as secretary and purchasing agent from 1924 to 1925. In 1926 he became secretary and assistant to the general manager and in 1928 was appointed assistant general manager. A year later he was appointed vice-president and remained in this position until 1950, when he became vice-president and general manager of the company.

During the First World War, Mr. Rutley served in France with the 3rd Canadian Battalion as a captain in the C.E.F.

He was president of the Montreal Builders' Exchange from 1931 to 1933 and in 1934 was elected vice-president of the Canadian Construction Association; he was president of the Association from 1936 to 1937. He is a member of the Corporation of Professional Engineers of Quebec.

Mr. Rutley is president and director of Foundation Maritime Limited, the Quebec Salvage Wrecking Company Limited; also a director of the Construction Equipment Company Limited, of Gunite and Waterproofing Limited, and of Atlantic Tug and Equipment Company Inc., Syracuse, N.Y.

F. G. Rutley, M.E.I.C.

R. E. Chadwick, M.E.I.C.

R. E. Chadwick, M.E.I.C., has been elected chairman of the Board of The Foundation Company of Canada Limited. Mr. Chadwick, a director of the Company, has been its president since 1928.

He joined the Foundation Company in 1911. He had graduated in 1906 in mechanical engineering from University of Toronto, and had spent two years on the staff of the University; and two years in the city engineer's Department, Toronto, as engineer in charge of bridges and docks.

With Foundation Company Limited, he served as superintendent and engineer, Montreal District; superintendent, Winnipeg District; Eastern manager, manager and acting chief engineer.

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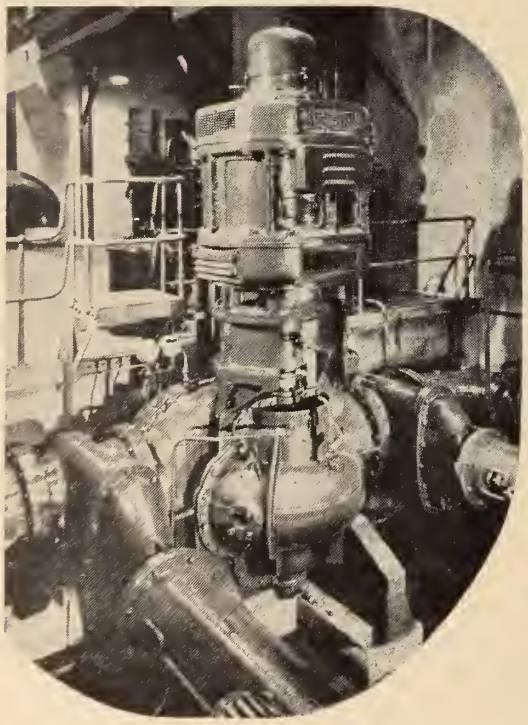

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Montreal; and served for a time as acting chief engineer, The Foundation Company of New York. Organizing The Foundation Company of Canada Limited in 1924, he became its vice-president and general manager and subsequently its president.

Mr. Chadwick is a director also of Foundation Maritime Limited, Halifax; of Quebec Salvage & Wrecking Co. Limited, Construction Equipment Company Limited, and Gunite and Waterproofing Limited, all of Montreal; and of Atlantic Tug & Equipment Co., Dover, Delaware. He is a member of the Corporation of Professional Engineers of Quebec.

H. A. Cann, M.E.I.C.

Harry A. Cann, M.E.I.C., has been appointed sales manager, mechanical goods, Edmonton Branch, Dominion Rubber Company Limited.

Mr. Cann joined the Company's Winnipeg Branch in 1938 after graduating in civil engineering from the University of Manitoba. A captain in the Royal Canadian Engineers in World War II, he saw overseas duty in Great Britain and North West Europe from 1940 to 1945. On his return to Canada and Dominion Rubber he joined the sales staff of the Company's Edmonton Branch and was active in that capacity until the time of his recent appointment.

S. G. Coultis, M.E.I.C., until recently vice-president and general manager of the Imperial Pipe Line Company Limited, has retired after 35 years in the petroleum industry in Alberta.

S. G. Coultis, M.E.I.C.

Born in Forest, Ontario, Mr. Coultis graduated as a chemical engineer from the University of Michigan in 1909. In 1913 he moved to Calgary where he became city chemist. Early in 1917, he went to Turner Valley to take over operations of the Dingman Oil Company on behalf of Imperial Oil interests. He was the first employee of Royalite Oil Company and in 1921 became plant manager and later a director. In 1939, he became president and general manager of the Valley Pipe Line Company in Calgary and in 1949 he went to Edmonton to his post with Imperial Pipe Line Co. Ltd. at Edmonton, Alta.

Mr. Coultis is a past president of the Professional Engineers of Alberta and a past vice-president of the Western Region of the Engineering Institute.

W. L. Dutton, M.E.I.C., is leaving Union Gas Company of Canada Limited to join F. E. Shaw Limited at Sarnia, Ont., as vice-president.

During World War II, he served in the armed forces from 1940-1946 with the rank of lieutenant colonel, and was awarded the O.B.E.

Mr. Dutton has been with the Union Gas Company at Chatham, Ont., since 1946, and became operations manager in 1948.

Alexander Campbell, M.E.I.C., contract engineer for the Western Division of the Dominion Bridge Company Limited at

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Winnipeg, Manitoba, has been appointed vice-president and manager, Western Division.

Mr. Campbell graduated from McGill University in 1924, and received his M.Sc. degree in 1926; he has been associated with the Dominion Bridge Company in Winnipeg for many years.

J. M. Fairbairn, M.E.I.C., has been elected president of Construction Borings Limited. Previously, he was vice-president of this Company and has been and will continue to be president of Charles Warnock and Company Limited, and a director of both companies.

H. J. Racey, M.E.I.C., has been elected vice-president of Construction Borings Ltd. He was previously general manager of this company and has been and will continue to be chief engineer of Charles Warnock and Company Limited, and a director of both companies.

D. C. MacCallum, M.E.I.C., has been elected vice-president of Charles Warnock and Company Limited, and a director of Construction Borings Limited. He was previously secretary-treasurer of Charles Warnock and Company Limited and has been and will continue to be a director of this Company and secretary of Construction Borings Limited.

Lt. Colonel S. Slater, M.E.I.C., is command engineer at Eastern Command headquarters of the Department of National Defence Army at Halifax, N.S.

Lt. Col. Slater had been in Ottawa since 1949 and previously served in the Quebec Command at Montreal, and at the Royal Military College at Kingston, Ont. During the war years he was stationed at Halifax and overseas, working on construction of military camps in England, and bridges and roads in Europe.

MAINTENANCE AND REPAIR DEPT.

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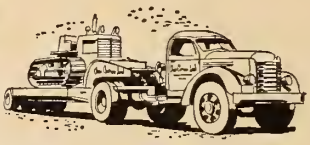
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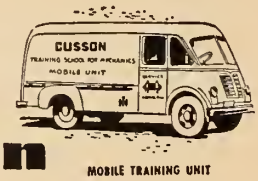

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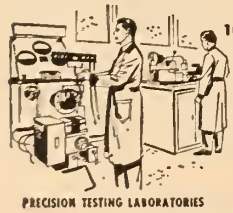
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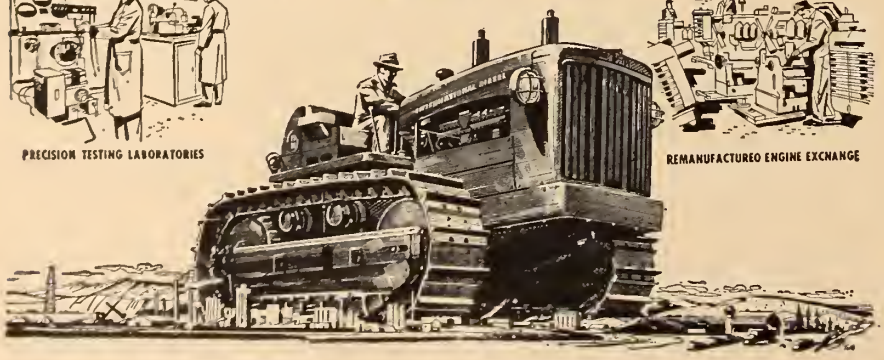

Erratum

A "Personal" about Jack Alton, M.E.I.C., appearing in the April issue was in error in stating that he had been appointed chief engineer with the Department of Public Works of British Columbia at Victoria. The item should have stated that Mr. Alton's appointment was to the position of chief designing engineer.

The *Journal* offers an apology to Mr. Alton and to its readers.

A. B. McEwen, M.E.I.C., assistant chief engineer for Canadian Industries Limited at Montreal, relinquished this position in March to take up duties as management representative in the West for C-I-L with his office in Vancouver.

N. S. Morrison, M.E.I.C., is with the Central Mortgage and Housing Corporation in Halifax, N.S.

Previously, he had been working with Defence Construction Limited at Halifax.

G. L. MacDonald, M.E.I.C., has been appointed district manager of the English Electric Company of Canada Limited at Winnipeg, Manitoba. Previously he was a sales engineer for the Company at Fort William, Ont.

Mr. MacDonald graduated in electrical engineering from the Nova Scotia Technical College in 1940.

H. Mugaas, M.E.I.C., has joined the Central Mortgage and Housing Corporation at Halifax, N.S.

In 1951, Mr. Mugaas was associated with the firm Hill-Clark-Francis Limited at New Liskeard, Ont. Previously he worked for many years with the Lamaque Gold Mines Limited at Bourlamaque, Que., as chief surveyor of the company.

Lt. Colonel J. S. Beeman, R.C.E., M.E.I.C., is at present in the Directorate of Engineering Development at Ottawa.

Lt. Col. Beeman had been senior highway engineer with the Northwest Highway System, at Whitehorse, Y.T., since 1950; previously he was command engineer with the Western Command, at Edmonton, Alta.

J. G. Kerfoot, M.E.I.C., has been appointed assistant plant manager for the Kaiser Aluminum and Chemical Corporation at their Newark Works.

Previously he was with Phillips Electrical Works at Brockville, Ont.

L. Foss, M.E.I.C., is with Aardal & Sunndal Verk in Oslo, Norway, where he is associated with the installation of an alumina reduction plant at Sunndalin.

Mr. Foss graduated as a civil engineer from the Royal Institute of Technology at Trondhjeim, in Norway, in 1927.

Since 1945, he had been working with the Foundation Company of Canada as a design engineer.

R. A. deVillers, M.E.I.C., is the assistant district engineer, for the Quebec district of Canadian National Railways, at Champlain Market, Quebec City. Previously he was division engineer, at Levis, Quebec.

Mr. deVillers graduated in civil engineering from Ecole Polytechnique in 1942 and worked for a time with the

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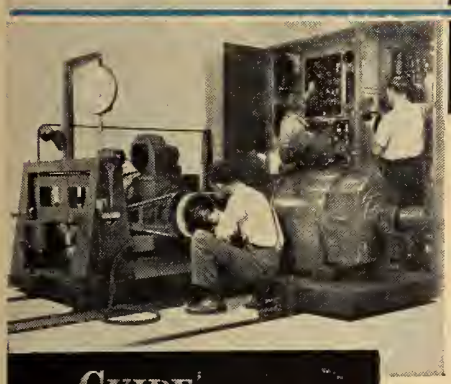

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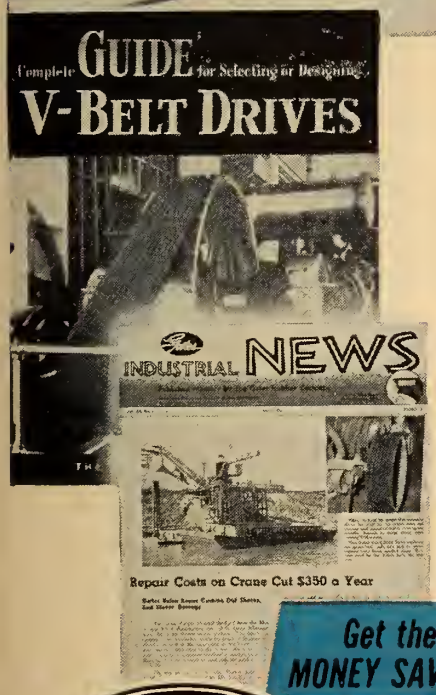

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Canadian Marconi Company, Montreal, as a mechanical engineer. In 1945 he entered the C.N.R. service as assistant engineer at the Bureau of Research.

J. P. Lecavalier, M.E.I.C., has joined the City of Montreal, Inspection Department. Previously, he had been in private practice at Montreal, Que., for a number of years.

Mr. Lecavalier is a 1937 graduate from the Ecole Polytechnique and has worked as assistant district engineer with the Roads Department of the Province of Quebec and later, with the engineering staff of the Drainage Bureau of the Department of Agriculture of the Province of Quebec at Montreal, before taking up private practice.

W. J. Dyck, M.E.I.C., has accepted a position as project engineer with Hydrocarbon Research Incorporated, at New York, and is joining the company's engineering office in Dusseldorf, Germany.

Previously he was process engineer with the Lummus Co., at New York, U.S.A., and earlier was a research investigator with the British Columbia Research Council at the University of British Columbia.

Mr. Dyck graduated from the University of Saskatchewan in chemical engineering in 1942.

A. H. W. Busby, M.E.I.C., superintendent of engineering research and development, for the Consolidated Mining and Smelting Company, Trail, B.C., is on an extended tour of Britain and South Africa. He has been granted leave of absence by the Consolidated Mining and Smelting Company to act as consultant on instrumentation to the Anglo-American Corporation of South Africa.

Mr. Busby left Montreal by air on April 23rd and after completion of some business in Britain, he will fly to North Rhodesia and to Johannesburg. He will return to Canada late in July.

E. T. Kirkpatrick, M.E.I.C., is the Edmonton Branch Manager of F. D. Bolton Limited; his position entails sales engineering of various types of electrical and mechanical apparatus.

Mr. Kirkpatrick graduated from the University of British Columbia in 1947 and then worked with the Canadian General Electric Company at Peterborough. He joined F. D. Bolton Limited as electrical manufacturers' agent in 1948, becoming assistant to F. D Bolton in 1949.

J. H. Richer, M.E.I.C., has been appointed assistant superintendent of transportation of the Montreal Transport Commission.

Mr. Richer studied at Brebeuf College where he obtained his B.A. in 1938; and at McGill University from which he graduated with the degree of B.Eng (mechanical) in 1943.

He served with the Royal Canadian Navy from early 1943 until the end of the war, as engineering officer aboard frigates and destroyers. In April, 1946, he joined the Montreal Transport Commission (then the Montreal Tramway Company) as assistant to the executive.

In 1949 he was appointed director of timetables and in February, 1952, he received the appointment to his present position.

J. H. Richer, M.E.I.C.

T. H. Dobbin, M.E.I.C., holds the position of commissioner of streets with the City of Sarnia, Ont.

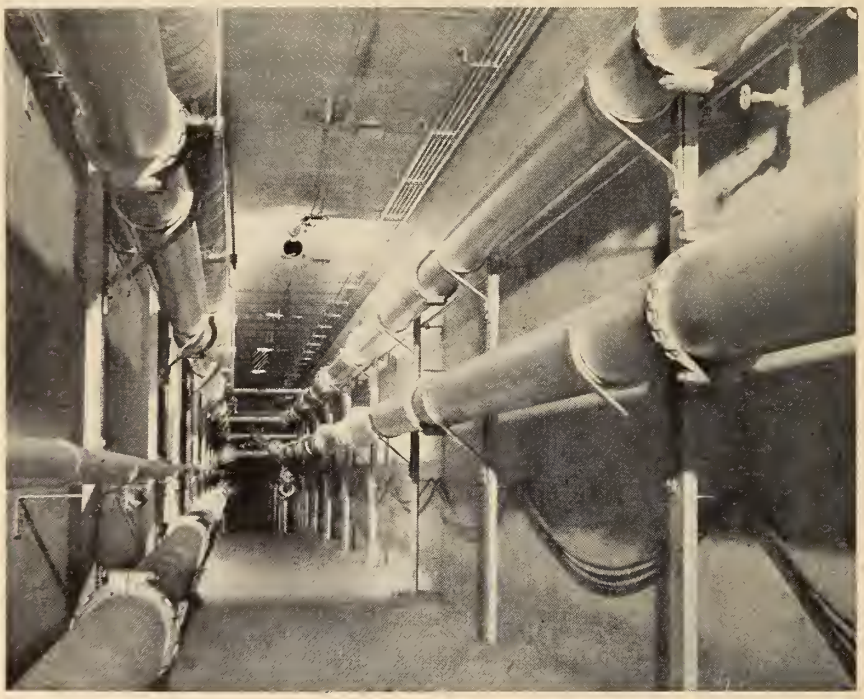
Previously he was a road engineer for the City Works Department of Saint John, N.B.

Mr. Dobbin graduated in civil engineering from the University of New Brunswick in 1949.

J. J. Baker, M.E.I.C., has joined C. D. Howe Limited at Montreal. Previously he was employed by the Montreal Locomotive Works and for a time he worked with the Canada and Dominion Sugar Company. In 1949, he was with the National Harbours Board working at the Montreal Harbour and prior to that worked as a designer with the Hydraulics Machinery Company Limited, Montreal, Que.

A. W. Bridgewater, M.E.I.C., has recently resigned from the position of assistant chief bridge engineer with the Depart-

(*Continued on page 527*)



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(*Continued from page 524*)
ment of Highways and Transportation of the Government of Saskatchewan to accept a position as an engineer in the Special Projects Branch, Department of Transport in Ottawa.

R. F. Hirtle, M.E.I.C., has been transferred by the Department of Highways and Public Works to Judique, Nova Scotia from Bridgetown, N.S.

Mr. Hirtle joined the Department of Highways and Public Works as resident engineer at Halifax, N.S., soon after graduating in civil engineering from the Nova Scotia Technical College in 1948.

J. M. Paquet, M.E.I.C., has left J. A. Y. Bouchard Inc. to join Tassé-Sarault and Associates, professional engineers, at Quebec City.

G. H. Finch, M.E.I.C., has been transferred by Canadian Westinghouse Company Limited from Montreal to Edmonton, Alta., as district manager.

Mr. Finch joined this company in 1922 and worked at Winnipeg, Calgary, and Ottawa. He graduated in electrical engineering from the University of Manitoba in 1924.

G. S. Langman, JR.E.I.C., has joined Stone and Webster of Trail, B.C., as a junior field engineer.

Mr. Langman graduated in civil engineering from the University of Alberta in 1950 and worked for a time with the Topographical Survey at Williams Lake, B.C. and at Ottawa, Ont.

H. D. Walford, JR.E.I.C., is working with Henry Morgan & Co., at Montreal.

Mr. Walford graduated in civil engineering from McGill University in 1949 and then attended Cambridge University; he worked for a time with James Bennett; Henry Morgan Co. Ltd., in London, England, before taking up his present position.

E. L. Weiss, JR.E.I.C., has recently resigned from his position as project and vessel inspector with Dow Chemical of Canada Ltd., at Sarnia, Ont., and has taken the position of refinery inspector with Canadian Oil Refineries Limited at Corunna, Ont. Mr. Weiss graduated in mechanical engineering from the University of Manitoba in 1950.

G. C. Marche, JR.E.I.C., is working as a construction supervisor for the Central Mortgage and Housing Corporation in Winnipeg, Manitoba.

Previously he worked as a mining engineer at the Creighton Mine at Lively, Ont. He graduated in mining engineering from the University of Alberta in 1950.

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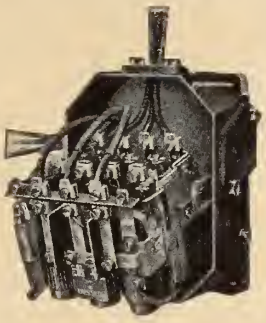

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G. M. Perry, JR.E.I.C., is employed in the Inspection Equipment Agency at the U.S. Army Chemical Centre at Maryland, U.S.A.

Mr. Perry graduated from the Nova Scotia Technical College in mechanical engineering in 1950.

M. H. Mayer, JR.E.I.C., has been employed with the Department of Highways of Alberta as a resident highway engineer, since his graduation from the University of Alberta in 1950, in civil engineering.

N. Smith, JR.E.I.C., is employed with the Aluminum Company of Canada Limited at Arvida, Que.

Mr. Smith graduated from the University of British Columbia in mechanical engineering in 1949.

Previously he has been production and maintenance supervisor with Molson's Brewery at Montreal, Que.

Capt. C. R. Baker, JR.E.I.C., has completed the 4th Technical Staff Officer's course at the Military College of Science at Shrivenham, Wilts, Eng., and is now attached to the War Office in London, England, with the Canadian Army Liaison Establishment.

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Captain Baker graduated in civil engineering from Queen's University in 1948 and before going to England was with the Directorate of Design and Development at Ottawa, Ont.

K. E. Barter, JR.E.I.C., is working with the Inspection Services of the Department of National Defence at Montreal. Previously he was with the Canadian Arsenals Ltd., at Leaside, Ont.

Mr. Barter graduated in electrical engineering from the University of New Brunswick in 1949.

H. L. Bachman, JR.E.I.C., is on a graduate engineers training course at the Canadian Westinghouse Company at Hamilton, Ont.

Previously he was with the Hydro Electric Power Commission of Ontario, at Toronto.

Mr. Bachman graduated in electrical engineering from the University of Manitoba in 1949.

R. A. Zurowski, JR.E.I.C., is working as electrical engineer with the Electric Parts Corporation at Chicago, U.S.A.

Mr. Zurowski graduated in electrical engineering from the University of Manitoba in 1945 and received a B.A. degree from the University of Saskatchewan in 1948, when he was for a time an instructor in the College of Engineering.

In 1947 he was with the Canada Cement Company Ltd., at Montreal, and in 1948 he worked for the Manitoba Power Commission at Winnipeg, Manitoba.

In 1950 he was Inspector of Stores for the Department of National Defense, with the Inspection Services of Canadian Arsenals at Leaside, Ont., and in 1951, with the Inspection Services of the Canadian General Electric Company at Peterborough, Ont.

A. Blais, JR.E.I.C., has been for some time working with the Panelyte Division of the St. Regis Paper Company (Canada) Limited, St. Jean, Que.

Mr. Blais graduated with a B.A.Sc. degree in chemical engineering from Laval University in 1950.

L. A. Butterfield, JR.E.I.C., has joined the Ainsworth Electric Co. at Toronto, Ont.

Previously, he was plant engineer with the Minneapolis Honeywell Regulator Co., at Leaside, Ont. Mr. Butterfield graduated with a B.A.Sc. degree in mechanical engineering in 1949.

J. F. Clarabut, JR.E.I.C., is with the Canadian Armament Research and Development Establishment at Valcartier, Que.

Mr. Clarabut graduated with a B.A.Sc. degree in mechanical engineering from the University of Toronto in 1950.

J. P. Champagne, JR.E.I.C., has joined Canadian Ingersoll-Rand at Sherbrooke, Que., as an electrical engineer.

Previously he was with the Beauharnois Light, Heat and Power Co. at Beauharnois, Que.

Mr. Champagne graduated in electrical engineering from McGill University in 1950.

J. Dick, JR.E.I.C., is a member of the Technical Service Department of the Canadian Oil Refineries Ltd., at Sarnia, Ont.

J. A. Lemelin, JR.E.I.C., is working with the Quebec Hydro-Electric Commission at Montreal.

Previously, he was with the Foundation Company of Canada Limited on the Atomic Energy Project at Chalk River, Ont.

Mr. Lemelin graduated in electrical engineering from Laval University in 1950 and worked for a time as an electrical engineer with Canadian Fairbanks Morse at Montreal, Que.

F. A. de Lory, JR.E.I.C., has been transferred by the Aluminum Company of Canada, from Montreal to Vancouver, B.C. He joined this company in 1951 after working for a time with the Consolidated Mining and Smelting Company of Canada Limited at Trail, B.C.

Mr. de Lory graduated from McGill University in 1948 and received a M.A.Sc. degree from the University of Toronto in 1951.

J. T. Currie, JR.E.I.C., is maintenance engineer with the McColl-Frontenac Oil Company Limited at Montreal, Que.

Mr. Currie graduated in mechanical engineering from the Nova Scotia Technical College in 1950.

A. D. Murphy, JR.E.I.C., is working with the Montreal Engineering Company at Mont Joli, Que. Previously he worked as a structural engineer with the Dominion Bridge Company Ltd., at Montreal.

Mr. Murphy graduated in civil engineering from the University of New Brunswick in 1950.

R. L. Walker, JR.E.I.C., of the Drainage and Irrigation Department, Jahore, Malaya, has recently been transferred to the State office at Jahore Bahru, in the capacity of assistant drainage and irrigation engineer, where he serves as personal assistant to the state engineer He will also be responsible for the Jahore South, Kluang, Segamat and Endau districts.

Mr. Walker graduated in civil engineering with a B.A.Sc. degree from the University of British Columbia in 1950.

R. J. Wood, JR.E.I.C., is with the Minneapolis Honeywell Regulator Company Limited at Montreal, Que. Previously he was junior engineer with the Canadian Celanese Limited at Drummondville, Que.

Mr. Wood graduated in mechanical engineering from the Nova Scotia Technical College in 1949.

G. P. Williams, JR.E.I.C., is with the Shipshaw Power Division of the Aluminum Company of Canada, at Arvida, Que.

Mr. Williams graduated in agricultural engineering with a B.A.Sc. degree, from the University of British Columbia in 1949 and then took a post graduate course in civil engineering at Utah State Agricultural College.

R. J. Trafford, JR.E.I.C., is a chemical engineer in the industrial engineering section of the Dominion Textile Company Limited at Montreal, Que. He has been with the same company at Magog, Que., since 1951.

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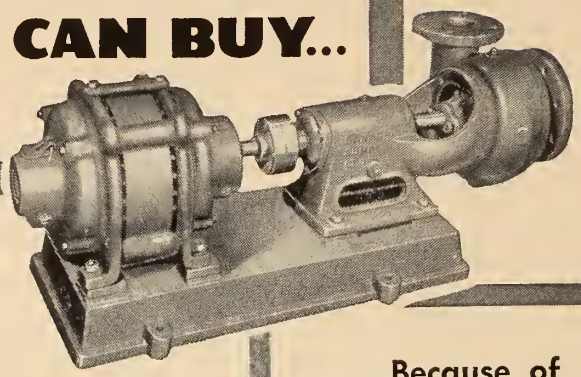

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Mr. Trafford graduated in chemical engineering from the Nova Scotia Technical College in 1950.

D. H. Rutherford, JT.E.I.C., is working for Stone and Webster Canada Limited at Trail, B.C.

Mr. Rutherford graduated in civil engineering from the University of Manitoba in 1950 and worked for a time with the Division of Building Research at the National Research Council, Ottawa, Ont.

C. P. Ronden, JT.E.I.C., has left Canadian Industries Limited, where he was a sales and service engineer in the paint and varnish division, to join the Canadian Chemical Company Limited at Edmonton, Alberta.

He is at present on a training course with the Celanese Corporation of America in the Petrochemical Division, at Kingsville, Texas, U.S.A., in preparation for the opening of the new plant at Edmonton.

Mr. Ronden graduated in chemical engineering from the University of Alberta in 1949.

J. A. Relf, JT.E.I.C., is working as a design engineer with the Dominion Tar and Chemical Company at Montreal.

Mr. Relf graduated in chemical engineering with a B.A.Sc. degree from the University of British Columbia in 1950.

Captain H. F. Protheroe, JT.E.I.C., is an Adjutant, with the H.Q., R.C.E.M.E. at Central Command Headquarters at Oakville, Ontario.

Mr. Protheroe graduated with a B.A. Sc. degree in engineering and business administration from the University of Toronto in 1949.

R. E. Phaneuf, JT.E.I.C., is working on subway planning with the Montreal Transportation Commission in Quebec.

He was previously a research assistant with the Defence Research Board at Montreal, Que., and earlier, worked for a time with the production control of the St. Lawrence Alloys and Metals Limited at Beauharnois, Que.

W. A. O'Neil, JT.E.I.C., is assistant resident engineer with the Department of Transport at Montreal.

Mr. O'Neil graduated in civil engineering from the University of Toronto in 1949 with a B.A.Sc. degree.

H. S. Ogilvie, JT.E.I.C., is with the Construction Equipment Company Limited at Halifax, Nova Scotia. Previously he was with the same company at Montreal, Que.

Mr. Ogilvie graduated in mechanical engineering from the Nova Scotia Technical College in 1950.

Major R. D. G. McQuillan, JT.E.I.C., occupies the position of general staff officer Grade II (technical) on the staff of the chief engineer at Army Headquarters at Ottawa, Ont. Previously he was second in command of the 23 Field Squadron, R.C.E., at Chilliwack, B.C.

Major McQuillan graduated in civil engineering from the University of Manitoba in 1950.

J. W. McPhail, JT.E.I.C., is a draughtsman with Swan, Rhodes and Wooster, consulting engineers, at Vancouver, B.C.

Previously he was an instrumentman with the Canadian National Railways at Vancouver, B.C.

Mr. McPhail graduated with a B.A.Sc. degree in civil engineering from the University of British Columbia in 1949; he was awarded the H. N. Ruttan Prize for the year 1948-49 for his paper on "The Design and Control of Asphalt Mixtures".

W. T. McBride, Jr.E.I.C., is working with Wilbur Watson Associates, consulting engineers at Cleveland, Ohio, U.S.A.

Mr. McBride graduated in civil engineering with a B.A.Sc. degree from the University of Toronto in 1946 and since 1947 had been working as a structural designer with the Canadian National Railways at Toronto, Ont.

C. D. McCulloch, Jr.E.I.C., is working as groundwood control engineer with the Abitibi Power and Paper Company Limited at Iroquois Falls, Ontario.

Previously, he had worked in the same capacity with the Manitoba Paper Company Limited at Pine Falls, Manitoba.

Mr. McCuloch graduated in electrical engineering from the University of Manitoba in 1947.

C. R. Morgan, Jr.E.I.C., is an instructor at the R.C.E.M.E. school at Kingston, Ont., with the rank of Lieutenant.

Lt. Morgan graduated in mechanical engineering from the Nova Scotia Technical College in 1950, and joined the permanent army soon afterwards.

D. U. Lowe, Jr.E.I.C., is working with the Jamaica Bauxites Limited at Mandeville, Jamaica, B.W.I.

Mr. Lowe was previously working as a trainee with the Aluminum Company of Canada Limited at Arvida, Que.

He graduated in chemical engineering from McGill University in 1950.

D. W. Lowrie, Jr.E.I.C., is working with the Ebasco Services, Inc., at La Oroya, Peru.

Previously, he was a superintendent of transmission lines power and substations for the Bolivian Power Company at Bolivia, South America.

A. J. Lemoine, Jr.E.I.C., is working as a signals draughtsman for the Canadian Pacific Railway at Winnipeg, Manitoba.

Mr. Lemoine graduated in electrical engineering from the University of Manitoba in 1951.

H. T. Lingham, Jr.E.I.C., is working with Crane Limited at Montreal, Que.

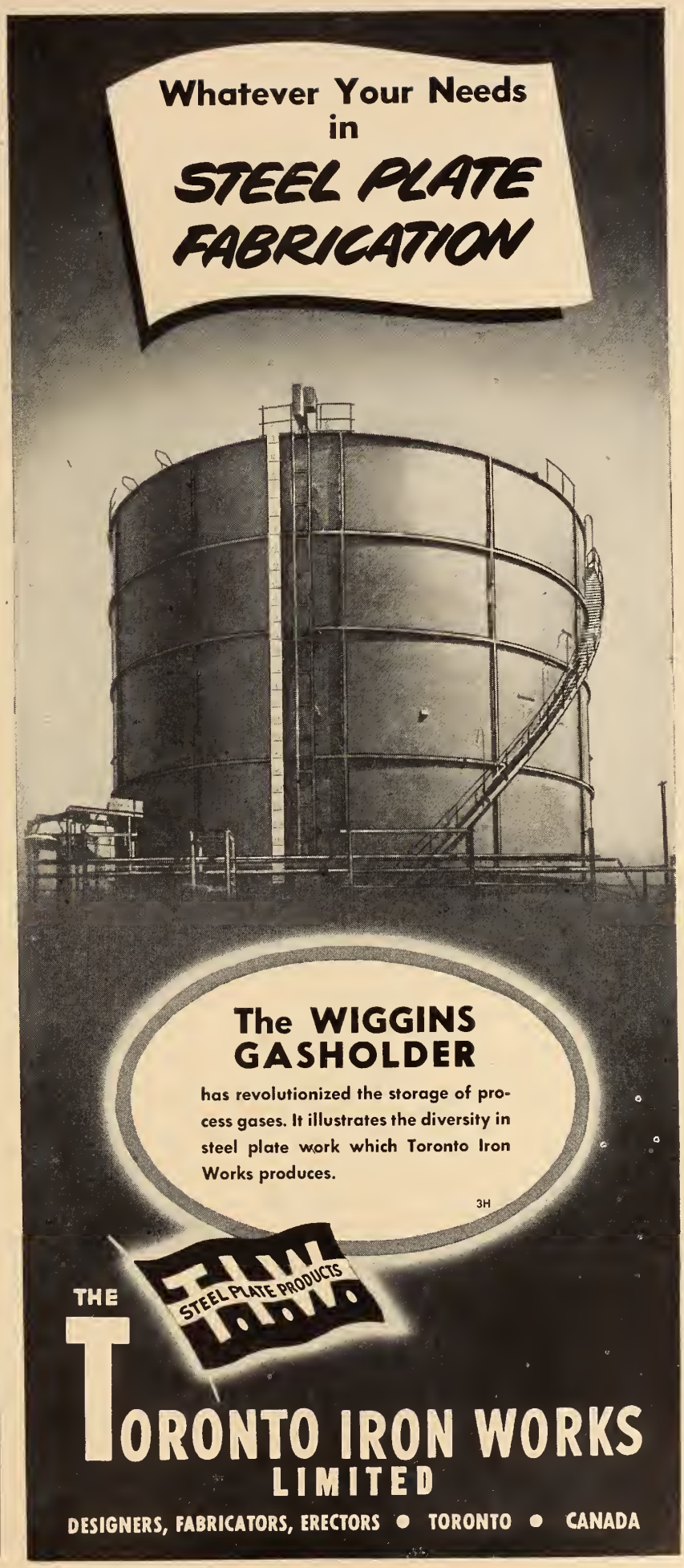
Mr. Lingham graduated in civil engineering from Queen's University in 1948, and in 1949 joined the Department of Highways of Ontario, at Toronto. Since 1950, he has been working as an engineer with Anglin Norcross of Toronto, Ont.

P. B. Le Bel, Jr.E.I.C., is a junior engineer with the City of Ottawa, Waterworks Department, at Ottawa, Ontario.

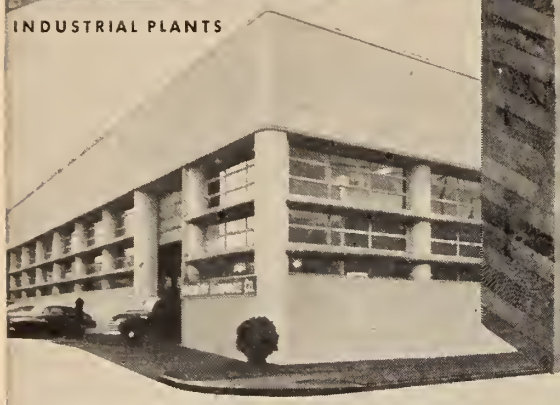
Mr. Le Bel graduated in mechanical engineering from McGill University in 1950.

W. C. Leith, Jr.E.I.C., is working in the design office of the Consolidated Mining and Smelting Company at Trail, B.C. Previously, he had been with the Dominion Engineering Works at Lachine, Que.

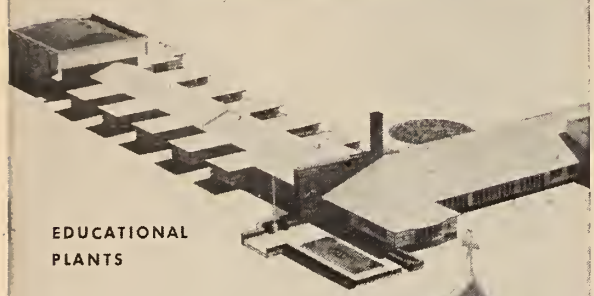
Mr. Leith graduated in mechanical engineering from the University of British Columbia in 1948 and received his M.A.Sc. degree in 1949.



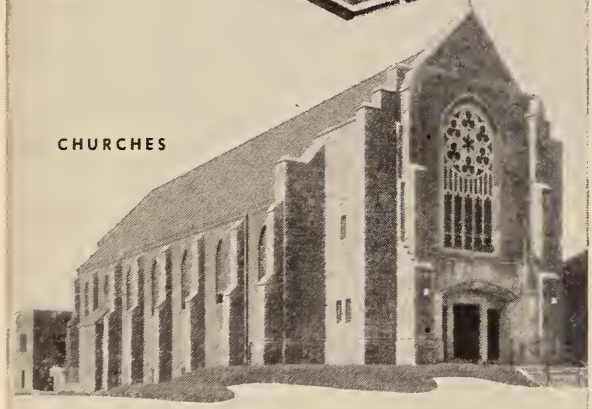
INDUSTRIAL PLANTS



WAREHOUSES

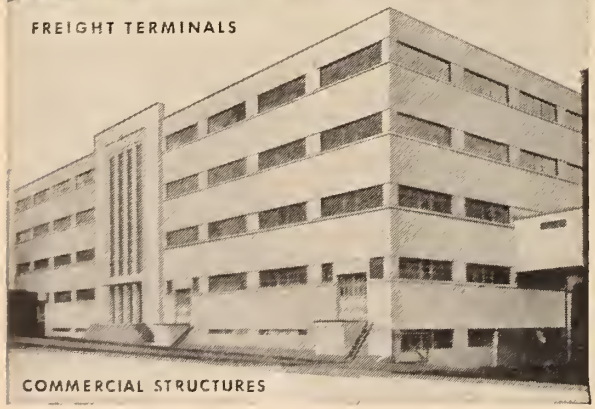


EDUCATIONAL PLANTS



CHURCHES

FREIGHT TERMINALS



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You can erect needed buildings *now!*

There's no need to postpone the construction of necessary buildings or additions for lack of suitable structural framing. *You can build now with our glued laminated (glulam) timbers which are available on short notice.*

This framing is not a substitute. Heavy timber framing used in conjunction with concrete or masonry walls has a long and enviable record as "mill construction". Glulam timbers now offer a further improvement in that all seasoning has been accomplished before installation in the building. Dimensions and position remain stable, and the surfaces are smooth and tight. Hence these timbers provide permanent construction with good appearance, economical costs and low maintenance.

Glulam timbers are "factory built" to the exact shape and dimension desired. They are formed of thoroughly seasoned structural quality lumber joined together under pressure by glues as permanent and strong as the wood itself. Timbers last indefinitely inside any building normally maintained against the weather. Where required by unusual conditions, special treatments are available.

Heavy timber framing effectively resists destruction by fire. Although timbers will burn, they yield strength slowly and stubbornly, allowing time for fire fighters to work. Frequently they are repaired in place, even after severe fires. As a result, insurance rates are favorable.

Timber Structures Ltd., can supply you with glulam timber columns, beams, girders, trusses and arches...in any quantity...fabricated or unfabricated. Our experienced engineering staff is always available for consultation with engineers and architects in working out problems of design.

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W. M. Kruse, JR.E.I.C., is employed with the Steel Company of Canada Limited at Hamilton, Ontario.

Mr. Kruse graduated in civil engineering from the University of Toronto in 1950.

J. P. Kot, JR.E.I.C., is a hydro engineer with Price Brothers and Company at Kenogami, Que. Previously he had been working as an inspector with the Boiler Inspection Insurance Company at Montreal, Que.

Mr. Kot graduated in electrical engineering from the University of Saskatchewan in 1949.

Erratum

The *Journal* acknowledges with regret an error in a Personal appearing in the March issue, concerning V. E. Campbell, S.E.I.C., of Hamilton, Ontario, which stated that he had joined the Canadian General Electric Company in Halifax.

Mr. Campbell has been with Canadian Westinghouse in Hamilton since 1951, when he graduated from the University of Saskatchewan in mechanical engineering. He is still with the Canadian Westinghouse Company.

The error resulted from confusion of similar names when referring to the records.

D. Dogherty, JR.E.I.C., is with the Fleet Aircraft Company at Fort Erie, Ontario.

Mr. Dogherty graduated in mechanical engineering from McGill University in 1949 and then took a post graduate course at Harvard University.

A. B. Drew, JR.E.I.C., is employed with the Imperial Oil Limited at Toronto, Ont.

Previously he was working with B. K. Boothe Construction at Toronto, Ont.

Mr. Drew graduated in civil engineering from Queen's University in 1950.

F. H. Foord, JR.E.I.C., is a designer with Richardson and Gordon, consulting engineers for highways and bridges, at Philadelphia, U.S.A.

Mr. Foord graduated with a B.Sc. degree in civil engineering in 1949 from the University of Manitoba, and worked for a time as a transitman in the division engineer's office of the Canadian Pacific Railway at Winnipeg, Manitoba.

R. P. Fillmore, JR.E.I.C., is working with the Department of Public Works at Ottawa, Ontario.

Previously he was with the Forests and Scientific Services of the Topographical Survey with the Department of Mines and Resources at Ottawa, Ont.

Mr. Fillmore graduated in civil engineering from the University of New Brunswick in 1949.

J. Gratton, JR.E.I.C., is working with Cimentaciones Franki de Mexico, South America.

Previously he was field superintendent with the Franki Compressed Pile Company of Canada at Montreal, Que.

Mr. Gratton graduated in civil engineering with a B.A.Sc. degree from the Ecole Polytechnique, in 1949.

R. A. Lefebvre, JR.E.I.C., is working for Electro-Vox Incorporated at Montreal, where he is in charge of the engineering department. Mr. Lefebvre graduated with a B.A.Sc. in electrical engineering from Laval University in 1949.

A. Shaw, S.E.I.C., is a laboratory assistant with the Canadian National Railways at Montreal, Que. He graduated in metallurgical engineering from the Nova Scotia Technical College in 1951.

W. A. McIntosh, S.E.I.C., is working with Minneapolis-Honeywell Regulator Company Ltd., at Hamilton, Ont. He graduated in engineering and business administration from the University of Toronto in 1951.

J. S. Jamshedji, S.E.I.C., is a junior electronics engineer with the Federal Electric Manufacturing Company Limited at Montreal. Mr. Jamshedji graduated in electrical engineering from McGill University in 1951.

A. A. Belanger, S.E.I.C., is a superintendent with the Eagle Pencil Company at Drummondville, Que. Mr. Belanger graduated in civil engineering from Nova Scotia Technical College in 1951.

R. A. Blount, S.E.I.C., is on a test course with the Canadian General Electric Company at Peterborough, Ont. He graduated with a B.A.Sc. degree from the University of Toronto in 1951.

O. A. Dodson, S.E.I.C., is a field engineer with the Foundation Company of Canada Limited, Toronto. He graduated in civil engineering in 1951.

B. H. Newington, S.E.I.C., is working with the Trans-Canada Highway Division of the Department of Resources and Development at Ottawa, Ont. Mr. Newington graduated from McGill University in civil engineering in 1951.

Cameron Kenny, S.E.I.C., has been elected president of the Engineering Undergraduate Society of McGill University. John Garneau, S.E.I.C., is first vice-president; and Claude Lacombe, S.E.I.C., is second vice-president.

Visitors to Headquarters

J. A. L. Smith, M.E.I.C., Edmonton, Alberta, March 28th, 1952.

R. J. Genard, Montreal, Quebec, March 29th, 1952.

W. J. Grant, M.E.I.C., Toronto, Ontario, March 31st, 1952.

F. C. Mechin, M.E.I.C., Toronto, Ontario, April 3rd, 1952.

H. S. Rossette, Sydney, N.S., April 3rd, 1952.

A. H. W. Busby, M.E.I.C., Trail, B.C., April 23rd, 1952.

T. S. Glover, M.E.I.C., Burlington, Ontario, April 24th, 1952.

S. B. Jubien, Montreal, Quebec, April 24th, 1952.

H. G. Hughson, M.E.I.C., Fredericton, N.B., April 25th, 1952.

A. Gromuik, M.E.I.C., Calgary, Alberta, April 29th, 1952.

Obituaries

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

H. A. Morrow, M.E.I.C., retired construction engineer. died at the Civic Hospital on April 1st, 1952, in Peterborough, Ont.

Mr. Morrow, was born in Peterborough, Ont., in 1866 and received his public school education at Trinity College School, Port Hope, and The Royal Military College at Kingston, Ont., where he graduated in 1887.

He began his active career as a rodman in the building of the Sault Ste. Marie Canal from 1899 to 1894 and became divisional engineer on the Trent Canal from 1894 to 1899.

From 1899 to 1906 he was assistant manager for the contractor on the Hillsboro Bridge at Charlottetown. P.E.I.

In 1908 he became associated with James A. Beatty of Toronto, organizing the firm of Morrow and Beatty, construction engineers.

The record of Morrow and Beatty for the next quarter of a century is an impressive story of achievement of the completion of many large electrical and industrial developments in northern Ontario, Quebec and New Brunswick. In 1915 the firm completed the pulp and paper mill of the Abitibi Power and Paper Company, which entailed the building of a concrete power dam 700 ft. long, with adjoining power house at Iroquois Falls, Ont. Two years later a similar project at the Smooth Rock Falls, pulp mill and hydro-electric development of the Matagani Pulp and Paper Company, was completed. Another Morrow and Beatty accomplishment was the hydro-electric power development of the Southern Canada Power Company at Drummondville, Que. At Bathurst, N.B., they built the hydro-electric development at Grand Falls on the Nepisquit River, for the Bathurst Company Limited, and another important contract was the harnessing of the Twin Falls in the Abitibi River for the Abitibi Power and Paper Company.

In 1925, Mr. Morrow went to Southern Ontario where his firm constructed the hydro-electric plant on the Trent River at Frankford for the Quinte and Trent Valley Power Company. In 1933, they built a hydro-electric plant for Spruce Falls Company on the Kapuskasing River. Many other contributions to the electrical development of Ontario and other sections of Eastern Canada were made by the firm of Morrow and Beatty by a series of developments and electric power sites and industrial properties.

Mr. Morrow was adjutant of the 57th Battalion from 1894 to 1899 and was the first Honorary Colonel of the Prince of Wales Rangers. He was a member of the Engineers Club and the Royal Military College Club at Toronto.

He joined the Institute as a Student in 1888, became an Associate Member in 1894 and Member in 1902; he attained his life membership in 1946.

Captain R. T. Bell, M.E.I.C., President of the Lakefield Boat Works, died in St. Joseph's Hospital on February 23rd, 1952, in Peterborough, Ont.

Mr. Bell was born in Glasgow, Scotland, in 1884 and was educated at St. John's College, Loughton, Essex, England. He came to Canada to work with the Canadian National Railways before the first World War and then joined the army to serve with the Engineering Corps, the Railroad Corps and finally for the British Admiralty, developing concrete barges. On his return after the war, he was associated with the Canadian National Railways' development work in northern Ontario, laying the line in the Nipissing area. From there he went into the contracting and concrete-mixing business. He later became construction superintendent for the Toronto-Hamilton highway, and engineer-in-chief of the Toronto Ready-Mix Concrete Company.

In 1932 he returned to England and for a number of years travelled throughout Great Britain and the Continent supervising the development of "Ready-Mix" plants, during which time he was granted several patents on a "Batching Plant". He returned to Canada in 1939 and represented the Jaeger Company in Canada, selling road construction equipment. In 1942 he became Government chief technical officer at the Genelco Plant of the Canadian General Electric Company. In 1945 he rebuilt the Lakefield Boat Works and was President until the time of his final illness.

Mr. Bell joined the Institute as a Member in 1921.

G. E. Martin, M.E.I.C., retired superintendent engineer with the Public Works Department at Ottawa, died on February 21st, 1952.

Mr. Martin was born at Moncton, New Brunswick in 1884 and was educated at the Aberdeen High School. He entered the Public Works Department in 1908, at Chatham, N.B., after graduating from McGill University with a B.Sc. degree, and held the position of assistant engineer. In 1921, he was promoted to senior assistant engineer and in 1923 he went to Saint John, N.B.; he was transferred to London, Ont. in 1925.

In 1935 he was selected by the Chief Engineer to join the Headquarters staff at Ottawa. He went to Ottawa in 1936 as Engineer, Grade I and some months later was promoted to Grade II. In 1939 he was appointed superintending engineer and retained this position until his retirement in 1949.

As a member of the Board of Engineers he was in close contact with all the major engineering projects in the Department but his special interest was in the development of the maritime provinces. During World War II, his services were utilized as a consulting engineer for the National Defence Department. He had a profound knowledge of the engineering and economic problems of the Atlantic coast and he constantly worked to advance the welfare of this territory.

Mr. Martin joined the Institute as an Associate Member in 1913 and became a Member in 1943.

D. R. Sanderson, M.E.I.C., of Toronto, Ont., died at his home on March 25th, 1952.

Mr. Sanderson was born in Toronto in 1922 and attended Runnymede Public School, Humberside Collegiate and the University of Toronto, where he graduated in civil engineering with a B.A.Sc. degree in 1944. He then joined Wallace Carruthers and Associates as a senior structural engineer. In 1951 he was appointed Alderman for Ward 7 on the Toronto City Council and was keenly interested in city planning and allied civic problems.

He was active in the C.C.F. party for a number of years and at the time of his death, was President of the High Park C.C.F. Club; he was also on the board of directors of Woodworth House.

Mr. Sanderson joined the Institute as a Student in 1944, became a Junior Member in 1945 and Member in 1952.

W. P. Near, M.E.I.C., of Ontario, died on March 28th, 1952.

Mr. Near was born at St. Marys, Ontario, in 1880; he received a B.A. degree from the University of Toronto in 1903 and a B.A.Sc. degree in 1907. From 1903 to 1904 he was a lecture assistant at the University in the Department of Physics. In 1905 he was a member of the First Canadian Eclipse Expedition to Labrador and in 1903 he spent some time with the International Boundary Survey 49th Parallel.

Following graduation he was employed on surveys and track revisions for the Temiskaming and Northern Ontario Railway and with the 60th Parallel between British Columbia and Yukon. In 1909 he joined the engineering staff of the Works Department in Toronto, in the main drainage office, later being appointed engineer-in-charge of trunk sewer construction.

In 1913 he was appointed City Engineer of St. Catharines, Ont., and remained in this position until 1923, when he took a similar position as City Engineer of London, Ont.

In 1932 he resigned to become manager of the Toronto division of the Supertest Petroleum Corporation and two years later accepted the position of City Engineer of London, Ont., becoming associated with the motor vehicles branch of the Department of Highway, Ont. and in 1937 he was appointed a commissioner on the Ontario Municipal Board.

Mr. Near joined the Institute as an Associate Member in 1909 and became a Member in 1920; he attained his life membership in 1946.

Employment Service

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

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

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

Situations Vacant

CIVIL

CIVIL ENGINEER required by large organization in Toronto. Recent graduate with experience in reinforced-concrete design for layout of hydro structures. Would consider senior draughtsman. Apply to File No. 4239-V.

CIVIL ENGINEER required by established company. Preferably with some experience in hydrology, for field and office investigations in the Province of Quebec. Apply to File No. 4243-V.

CIVIL ENGINEER, bilingual preferred to act as general construction superintendent for a leading Montreal company. Must have good knowledge of airport and wharf construction. With at least 8 to 10 years of experience, applicant should be energetic and capable of supervising a general construction organization. Good salary. Excellent future prospects. Group insurance, hospitalization and pension benefits. Applications treated confidentially. Our staff knows of this advertisement. Apply to File No. 4247-V.

YOUNG CIVIL ENGINEER required by large transportation company in Montreal for duties in bridge department and other railway structures. Apply to File No. 4251-V.

ELECTRICAL

PROFESSIONAL ENGINEER with good electrical background and adequate experience to manage and plan maintenance and extensions to Hydro, gas and water utilities systems in a town in South Western Ontario with a population of 8,000. Very favourable living conditions. Salary in accordance with experience but in the range of $5,500.00 to $6,500.00 for the type of man desired. Apply giving age, education and brief outline of past experience. Apply to File No. 4238-V.

ELECTRICAL ENGINEER RECENT graduate for foreign service of large Canadian company to undergo development in preparation for a specific engineering assignment. To undergo 3 months training period in Toronto. Prefer single men. Apply to File No. 4239-V.

ELECTRICAL ENGINEER required by large organization in Ontario. Applicant should have 1 to 3 years experience preferably on a test course or with a utility, for specification writing, supervision of acceptance tests, liaison with manufacturers checking drawings, and comparison of tenders. Apply to File No. 4239-V.

YOUNG ELECTRICAL ENGINEER required who is interested in sales in the power and electronic fields. Applicant would be stationed in Ottawa, and would cover territory extending from Cornwall to Kingston, Pembroke, and all Northern Ontario and Quebec Mining areas. Apply to File No. 4242-V.

ELECTRICAL SALES ENGINEER required for Southern Ontario area with knowledge of motor design and application. Apply stating experience and salary requirements. Apply to File No. 4254-V.

MECHANICAL

ASSISTANT PROFESSOR REQUIRED BY University located in The Maritimes to teach various subjects to third and fourth year students in the mechanical engineering department. A man with some teaching experience would be preferable, however consideration will be given to applications from anyone interested in university work who has had a few years of industrial experience. Apply to File No. 4236-V.

MECHANICAL ENGINEER required for foreign operation of large Canadian company to act as assistant chief of power plant and station division, supervising operation and maintenance of large hydro-electric plants having reaction turbines. Prefer 8 years similar experience. Apply to File No. 4239-V.

MECHANICAL ENGINEER required in Ontario to design diesel power applications, study specifications and prepare estimates for industrial and marine power plants, pumping stations and diesel generator sets. Able to make up detailed instructions for shop fabrication of assemblies and to assist salesmen on calls requiring technical information. Prefer a man about 40 years of age with ten years experience in some heavy industry such as mining or construction work. Marine engine or shipyard experience valuable. Extensive training on General Motors diesel engines of all sizes will be provided. Apply to File No. 4240-V.

MECHANICAL DESIGN ENGINEER required by paper converting company located in Southern Ontario. The work consists of machine designing, plant layout, and maintenance engineering. Qualifications should be a degree in engineering with a natural talent for designing mechanical devices. Apply to File No. 4241-V.

MECHANICAL ENGINEER recent graduate, bilingual, required, interested in engineering sales. Equipment consists of industrial pumping centrifugal, reciprocating, rotary, conventional deep well turbine pumps, etc. The work will entail the promotion of these lines with consulting engineers and industrial and municipal accounts throughout the province of Quebec, with headquarters in Montreal. Remuneration will be on a salary plus commission basis. Apply to File No. 4244-V.

MISCELLANEOUS

PROFESSIONAL ENGINEER required by public utility in Maritime Province, to act as assistant superintendent of steam generating station. Experience required in operation of pulverized fuel fired boilers, and steam turbines in 20 to 30 thousand kilowatt range, 600 p.s.i.g., 815 degree steam conditions. Two machines now in operation, and two on order for operation in 1953 and 1955 to meet rapidly growing load. Apply to File No. 4237-V.

TECHNICAL ASSISTANT required for foreign operation of large Canadian company to supervise gas-main construction, maintenance of mains and regulators, compressors, balancing of gas pressures, market surveys and load forecasting. Prefer Higher Certificate in gas engineering (supply). Apply to File No. 4239-V.

FIVE JUNIOR GRADUATE engineers recently graduated prepared to follow through a period of training in the various shops with a view to becoming junior production engineers. While mechanical engineers are preferred, men from other allied engineering branches will receive full consideration. Location Ontario. Apply to File No. 4245-V.

ENGINEER TO ACT as scheduler for operations in Ontario. Must have experience in the preparation of master and detailed schedules for the production of aircraft or other products where fabrication, sub-assembly and assembly are involved. Apply to File No. 4245-V.

STATISTICAL ENGINEER (industrial) required for rapidly growing operations in Ontario. Young graduate in engineering (any branch) or graduate in arts or science. In particular this position requires first class statistical analysis ability. Apply to File No. 4245-V.

FOUR METHODS AND TIME STUDY men for rapidly growing operations in Ontario. Must be prepared to take over all time study and methods work for a whole department and be prepared to supervise one or two juniors. Apply to File No. 4245-V.

METHODS AND TIME STUDY SUPERVISOR required by rapidly growing organization in Ontario. This man must be capable of supervising time study and methods department, compiling synthetic standards and conducting work simplification programmes. Engineering degree or equivalent an asset. Apply to File No. 4245-V.

CHEMICAL OR MECHANICAL ENGINEER recent graduate required by rubber company in Ontario. He will be given thorough training and experience on production problems related to compounding and technical control. With

City Engineer Required by City of Calgary

DUTIES

As administrative head of the city Engineering Department to promote, plan, co-ordinate and direct the execution of all municipal engineering projects including the construction and maintenance of bridges, underpasses, streets, roads and sidewalks; the development, maintenance and operation of sewers, sewage disposal plants, garbage collection and disposal system; traffic control; and the building inspection program. To prepare estimates and budgets and report on departmental activities. Applicants should advise concerning experience in supervision of water works treatment and distribution system.

QUALIFICATIONS

University graduation in civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or and equivalent combination of training and experience.

APPLICATIONS

To be made in writing to Personnel Director, City Hall, Calgary, Alberta, stating salary required.

experience this man should be able to demonstrate leadership qualities and become eligible for supervisory and managerial positions as required. Apply to File No. 4248-V.

SENIOR CONSTRUCTION administrative assistants to assist senior construction executives in administration of large construction programme in Eastern Canada. Executive ability and thorough knowledge of construction procedures required. We also need construction office managers to take charge of isolated construction offices including payrolls, inventories, personnel records, construction reports, etc. Previous experience in complete charge of construction office required. Salaries open, excellent opportunities. Apply to File No. 4249-V.

SENIOR STRUCTURAL STEEL designer required by Montreal office of consulting firm. Salary open. Apply to File No. 4250-V.

THE CIVIL SERVICE COMMISSION is assisting in the recruitment of a number of communications engineers, radio engineers, telephone and telegraph engineers and submarine cable engineers for appointment to civilian posts for foreign service. Apply to File No. 4252-V.

ELECTRICAL OR MECHANICAL ENGINEER required in Ontario for industrial cycle conversion programme. Apply to File No. 4253-V.

SALES ENGINEER FOR CENTRAL ONTARIO. Knowledge of woodworking, metal working, pulp and paper making machinery. Apply to File No. 4255-V.

YOUNG MECHANICAL OR CHEMICAL ENGINEER wanted to be trained as process engineer for modern welding electrode factory in Montreal. Applicant should be between 20 and 25 years of age and have a good grounding of inorganic chemistry and some experience in Mechanical engineering. Applicant will receive, after initial local experience, a thorough training in similar plant in U.S.A. Position offers advancement with growing concern, pension and insurance benefits and good remuneration. Apply to File No. 4256-V.

YOUNG GRADUATE ENGINEER with diesel experience required by organization in Ontario for expanding production programme. Also require engineer with some knowledge of diesel engine construction. Apply to File No. 4257-V.

YOUNG GRADUATE ELECTRICAL engineers wanted for training programme of well established consulting engineering organization associated with electric utility companies in Latin America including Mexico, Columbia, Cuba and other countries. Training will include work in New York office and also with one or more operating companies. Final assignment may be work in New York office with occasional field trips or with operating company depending on preference of employee and needs of employer. Excellent opportunity for good men interested in this type of work. Apply to File No. 4258-V.

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

CHEMICAL

CHEMICAL ENGINEER, preferably a recent graduate required by a well established Toronto manufacturer for laboratory work on production problems. Apply to File No. 4179-V.

CHEMICAL ENGINEER, recent graduate preferred, with or without post graduate work. The position is that of chemical process design involving hydrocarbon distillation and heat exchange. This is a good opportunity for a young engineer to develop his theoretical and practical knowledge in one of the most advanced applications of thermodynamics. Salary according to qualifications. Location Montreal. Send complete resume of education, experience if any, and recent photo to File No. 4197-V.

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

CHEMICAL ENGINEER for development and control work in a pulp and paper mill located in Province of Quebec. Good starting salary, excellent opportunities. Apply in detail. Apply to File No. 4222-V.

CHEMICAL ENGINEER, recent graduate required for technical work in sales department of well established Toronto manufacturer. Apply to File No. 4223-V.

CHEMICAL ENGINEER required with intimate experience in the field of biochemistry and allied processes. Man needed for this position must be capable of giving independent direction on various projects under way. Should have no objection for overseas duties. Present staff have been informed. Apply to File No. 4230-V.

CIVIL

CIVIL ENGINEER, recent graduate required for city engineer's office in Ontario. Work involved is concerned with making surveys, layouts, inspection and control of construction of streets, and sewers, and miscellaneous municipal construction. Apply to File No. 4174-V.

CIVIL ENGINEER, recent graduate, preferably with some experience on reinforced concrete design of hydro-electric structures such as dams, powerhouses, and pumping stations is required by a large Canadian company with operations in Brazil. Location Toronto. Pension plan and other benefits. Apply to File No. 4225-V.

CITY ENGINEER required by large city in Western Canada to act as administrative head of the City Engineering Department to promote, plan, coordinate and direct the executive of all municipal engineering projects. University graduate in civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or an equivalent combination of training and experience. Apply to File No. 4227-V.

ELECTRIC

RADIO DESIGN ENGINEER required in Ottawa. University graduate preferably master's level with 5-10 years practical experience in the design of electronic devices, particularly those involving pulse techniques, used in radio wave propagation research measurement and communications. Must be capable of organizing and directing technical operations of a development laboratory, and of acting as a consultant on radio engineering problems. Interested applicants, who are Canadian or British subjects, please quote File No. 52-E-1. Apply to File No. 4172-V.

ELECTRICAL ENGINEER required by manufacturer in Ottawa, Ontario. Applicant should be capable of both sales and development work, the development work would involve the preparation of schematic and actual wiring diagrams and field service work. Apply to File No. 4204-V.

SALES ENGINEER required by manufacturer in Montreal. Applicant should be graduate in electrical engineering or electronics and have about 3 or 4 years experience in sales work. Apply to File No. 4209-V.

ELECTRICAL ENGINEER with communications option or graduation in physics required in Montreal. Previous experience with air force electronics work desirable but not essential. Should be able to write and interpret specifications and be office type as this is altogether desk work. Salary open. Apply to File No. 4210-V.

ENGINEER REQUIRED by electrical manufacturer in Toronto to engineer, produce and sell electrical connectors. Apply to File No. 4229-V.

ELECTRICAL ENGINEER to act as sales engineer for manufacturer located in Toronto of electrical and power house equipment. Some experience desirable and free to travel. Company car supplied. Apply to File No. 4229-V.

MECHANICAL

TWO MECHANICAL ENGINEERS, recent graduates required for initial training in the valve and fitting department of organization in Montreal to be absorbed eventually in sales or other branches. Apply to File No. 4170-V.

SALES ENGINEER, preferably mechanical for organization in Montreal handling heavy equipment. Location Eastern Canada. Salary open. Age 28 to 35 preferably married. Apply to File No. 4171-V.

CHEMICAL ENGINEER

Terrace Bay

(north Shore of Loke Superior)

Noture of Duties:

To work os sulphote control engineer on technical staff of new modern pulp mill. Work consists lorgely of special problem assignments, with o minimum of routine duties. Problems ore varied in character ond may include those of process development, process control, economic return, development of testing procedures, or other assignments of a development of mill research nature.

Qualifications:

Preference to o recent graduote anxious to become established in pulp and paper field.

Good storting salary ond opportunities. Apply fully in writing stating age, University record, work history and ovoilability to Personnel Superintendent, Long Loc Pulp and Paper Co. Ltd., Terrace Bay, Ontario.

MECHANICAL ENGINEERS to act as project engineers with experience in chemical or allied industry preferred but not essential. Location Ontario. Apply to File No. 4176-V.

MECHANICAL ENGINEER with about 10 years of design and shop experience, familiar with machining and welding techniques, writing of specifications, etc., required by Montreal office of consulting engineer. Apply to File No. 4177-V.

THREE MECHANICAL ENGINEERS, university graduates with one or more years of machine design experience. Location Montreal, office of consulting firm. Apply to File No. 4177-V.

MECHANICAL ENGINEER or graduate in engineering physics, experience not essential, but must be suitable for calculations relating to stress analysis, thermo-dynamics and hydraulics required for Montreal office of consulting firm. Apply to File No. 4177-V.

MECHANICAL ENGINEERS required by large automotive industry in Ontario for the time standards and methods department and for production engineering. Apply to File No. 4178-V.

MECHANICAL ENGINEER required in Province of Quebec by pulp and paper industry for design and layout. Apply to File No. 4189-V.

MECHANICAL ENGINEER with pulp and paper experience required for Montreal office of the industry. Applicant should have experience in checking, draughting, recording, etc. Salary open. Apply to File No. 4189-V.

YOUNG GRADUATE mechanical engineers required for Mexico, Colombia and other central and South American locations, for a period of two or more years. This is an unusual opportunity for young engineers to be trained under superintendents in various steam and diesel power stations so that their experience would not be limited to one plant or in relationship to only one plant superintendent. After training these engineers would if they wish, be sent to head office in the U.S.A. to act as liaison officers between field and office and thus assist in the start up of new generating stations. A thorough knowledge of the English language is essential. Apply to File No. 4193-V.

MECHANICAL ENGINEERS for process and or mechanical engineering work required by large pulp and paper mill. Single men preferred who have experience in the paper industry although experience is not absolutely necessary. Apply to File No. 4218-V.

ASSISTANT PROFESSOR for vacancy on the mechanical engineering staff of a university located in the Maritimes, to teach various subjects to third and fourth year students. Applicant should have preferably some teaching experience. Would consider application from anyone interested in university work who has had a few years of industrial experience. Apply to File No. 4221-V.

MECHANICAL ENGINEER PREFERABLY a recent graduate, required by well established Toronto manufacturer for factory engineering department. Apply to File No. 4223-V.

MISCELLANEOUS

THERE IS AN opening for an ambitious young man, who is not afraid of hard work and a challenging job in the advertising department of a large organization in Montreal. Applicant should have a minimum of 3 years advertising experience preferably industrial. A degree in engineering or science desirable but not essential. Good salary and opportunities for advancement offered to properly qualified man. Apply with full details of experience, education and salary expected. Apply to File No. 4169-V.

AN INSTRUMENT ENGINEER required in Ottawa to maintain, control and calibrate all measuring equipment used in radio physics or electronics laboratory. Design or modifying equipment for special measurements required by any section of the laboratory. Minimum of 5 years practical experience in operation and maintenance of electronic measuring equipment. Should have a sound background in techniques of pulse measurement. The initial appointment for this position will be at a salary not greater than $3,800.00 per annum. Interested applicants who are Canadian citizens or British subjects please quote File No. 52-E-12. Apply to File No. 4172-V.

TECHNICAL SALES engineers with experience in chemical or allied industry preferred, required by large chemical industry in Ontario. Also sales engineer with experience in injection moulding. Sales offices in Toronto and Montreal. Apply to File No. 4176-V.

A LARGE PULP AND paper mill located in Southeastern Quebec has an immediate opening for a superintendent for its 300 ton kraft mill. Applicant should be fully experienced in mill operations, in control and study of technical problems, and in handling men. Graduate mechanical or chemical engineer with some knowledge of French. Please give full particulars of experience, education, age, etc., with first reply, which will be considered confidential. Apply to File No. 4180-V.

SALES ENGINEER required with 3 or 4 years experience in sales and development of materials handling, preferably in mining or pulp and paper industry. Location, working out of Toronto or Montreal. Apply to File No. 4185-V.

RESEARCH ENGINEER required in Ottawa. University graduate in engineering specializing in thermdynamics, to conduct low temperature tests of mechanical equipment in cold chambers and to supervise operations of 1,000 H.P. ammonia refrigeration plant. Some experience with plant operation and test work required. Initial salary up to $4,000 depending on age, qualifications and experience. Apply by air letter giving full details to File No. 4187-V.

MECHANICAL OR ELECTRICAL ENGINEER, to operate sub-contracting section dealing with small electronic/mechanical assemblies. Should be familiar with Canadian industry in this field and have experience handling sub-contract details. Salary dependent on qualifications. Apply to File No. 4194-V.

YOUNG CIVIL OR MECHANICAL engineer required by pulp and paper company in Quebec. Applicant should be fluent in either French or English and able to make himself understood in either. Apply to File No. 4195-V.

MUNICIPAL ENGINEER to take charge of construction and maintenance and act in consulting capacity on water and fire system in municipality on Pacific Coast. Permanent work for right person. Reply giving date available, experience, references, present salary and salary expected. Apply to File No. 4196-V.

ENGINEERING COMPANY engaged in the design, manufacture and erection of chemical process plants in Canada and U.S.A. requires the services of a field erection superintendent. Plant erection involves responsibility for field planning, organization and supervision right through to completion of the job. Company headquarters in Montreal. We prefer a civil or mechanical engineer with 4 to 5 years experience in field erection of process equipment as used in the petroleum industry. Salary according to qualifications. Send complete resume of education, experience and recent photo to File No. 4197-V.

COMBUSTION Engineer salesman, preferably young man with knowledge of and experience with coal burning equipment and also flare for product research and development. Must have pleasant attributes of sales personalities and willingness to travel contacting coal industrial users and retail dealers particularly in Western Canada. Prospect of advancement to sales manager upon proving suitability. Liberal salary plus bonus arrangement to right man. Travel paid and car furnished if necessary. Apply to File No. 4199-V.

CHIEF ENGINEER OF chemical and industrial research department of textile manufacturing plant in Province of Quebec. Applicant should have some experience in refinery practice in oil lubrication. Salary open. Apply to File No. 4201-V.

ASSISTANT TO CHIEF engineer of research and control departments required by textile manufacturer in Province of Quebec. Applicant should be preferably Ph.D. with administration experience and knowledge of textile industry. Apply to File No. 4201-V.

General Construction Superintendent

REQUIRED FOR A LEADING MONTREAL COMPANY

Civil engineer, bilingual preferred. Must have good knowledge of airport and wharf construction. With at least 8 to 10 years of experience, applicant should be energetic and capable of supervising a general construction organization. Good salary. Excellent future prospects. Group insurance, hospitalization and pension benefits. Applications treated confidentially. Our staff knows of this advertisement. Apply to File No. 4247-V.

TRANSFORMER DESIGN ENGINEER

THERE is real opportunity in our expanding organization for a progressive engineer with modern ideas and aggressiveness to put them into effect.

THE right man can grow with this growing concern.

OUR company, located in Ontario, is well established in the transformer business.

FIVE years distribution transformer experience desirable, but not requisite for the man possessing other suitable qualifications.

REPLY should include general personal data, detailed experience record, with specific regard to types of transformers designed, and recent photograph.

EMPLOYEES of our company have been notified of this opening.

APPLY to File No. 4220-V.

SALES ENGINEER for Toronto office of large railway supply organization. Practical mechanical ability an asset. Railway experience preferred but not absolutely necessary. Excellent opportunity for young aggressive man. Pension plan, automobile, etc. Write giving details and including photograph to File No. 4202-V.

TECHNICAL EDITOR required by rapidly growing research organization (both fundamental and applied). First class man to advise in the initial draughting, and carry out final processing, of scientific and technical communications. This man must be capable of working with project supervisors toward the clear and accurate expression of research concepts and results. A science degree and published research, plus some writing experience are therefore essential, academic and industrial experience are both desirable. Salary commensurate with qualifications, permanent position, central location in Montreal. Reply giving full resume of career to File No. 4203-V.

CHEMICAL ENGINEER or practical chemist required by American organization to establish headquarters in Windsor, Ontario and travel in Canada. Initial assignment would be plan and help implement a sales programme in the metal treating chemicals field. Applicant must be sales minded and preferably with experience in chemical sales. He should be between 30 and 40 years of age and be a Canadian citizen. Of prime importance he must be able to work with present personnel gracefully and gradually assume a position of leadership. He must be of executive calibre and proven ability. Apply to File No. 4205-V.

ASSISTANT ENGINEER for research and teaching of farm machinery in the agricultural engineering department of an Eastern Canadian college. Research will include field experimental work on tillage and harvesting machinery primarily. B.S. degree in agricultural engineering or equivalent with M.S. degree with major emphasis on farm machinery. Farm background and good cooperation with initiative and willingness to work essential. Good opportunity for growth and promotion. Salary open depending on training and experience. Apply to File No. 4206-V.

ASSISTANT AGRICULTURAL engineer for research and teaching of rural electrification in the agricultural engineering department of an eastern Canadian agricultural college. Bachelor of Science in agricultural engineering or electrical engineering with master's degree relative to subject of rural electrification. Good opportunities for development work and promotion. Salary based on training and experience. Apply to File No. 4206-V.

ENGINEERS REQUIRED by large industry in Ontario in aircraft wing plant; process engineers, training supervisor. Maintenance department; mechanical engineers and construction design engineers. Industrial engineering; materials handling engineers and tool and die designers. Apply to File No. 4212-V.

JUNIOR PLANNER for metropolitan planning commission of Greater Winnipeg. Qualifications, graduate in architecture or engineering, preferable with specialization in planning or graduate in other related fields with some planning experience. Duties: zoning, subdivision problems, and draughting related thereto. Salary $3,000 to $3,600. per annum. Apply to File No. 4216-V.

LUBRICATION ENGINEER required in a large Eastern Canadian paper mill. Applicants should state age, experience, marital status as well as other relative information. Apply to File No. 4217-V.

ENGINEER to take charge of lecture and laboratory work in industrial electronics and servo mechanisms at a university in Eastern Canada, commencing September, 1952. Rank and salary dependent on qualifications. Apply to File No. 4219-V.

TRANSFORMER DESIGN ENGINEER required by well established organization in Ontario. Real opportunity offered in an expanding organization for a progressive engineer. Five years distribution transformer experience desirable, but not essential, for the man possessing other suitable qualifications. Reply should include general personal data, detailed experience record, with specific regard to types of transformers designed and recent photo. Apply to File No. 4220-V.

SALES ENGINEER required by well known manufacturer of product used in Canadian Pulp and Paper industry has opening for sales man in the thirties, preferably with background in paper manufacturing or sales and with technical education. Unusual opportunity for right man. Would have several months training in our own plant and in the field. Apply to File No. 4224-V.

ENGINEERS in training B.C. Forest Service. Salary $258.-$308. per month. Graduate in civil or forest engineering, registered as engineer in training with Association of Professional Engineers of B.C. Promotional opportunities, positions permanent, superannuation plan. British subjects, not over 45, except ex-service men given preference. Apply to File No. 4228-V.

ASSISTANT HYDRAULIC ENGINEERS for water rights branch, Department of Lands, Victoria, B.C. Salary $288.00 to $338.00. Graduates in engineering, preferably civil; eligible for registration as engineer-in-training in B.C., Professional Engineers' Association. Photogrammetry, hydraulics and hydrology of river discharge, some knowledge of dam design, soil mechanics and soil sampling, preferably some experience on engineering work in hydro-electric, irrigation or hydrology fields. Positions permanent. Superannuation plan. Promotion to hydraulic engineer, maximum salary $413.000 on completion of full professional registration. British subjects, under 45 years unless ex-servicemen. Apply to File No. 4228-V.

CITY IN ONTARIO is organizing a planning department and asks for applications for the position of Planner. Work includes revision and consolidation of the zoning by-laws, screening subdivisions, major street system, and school building programme. Experience in planning is desirable but not necessary. Applicants must be university graduates with a definite interest in planning, and preference will be given to training in engineering. Please state salary. Apply to File No. 4231-V.

SEVERAL ENGINEERS with ability and initiative wanted as soon as possible, for young company; will eventually become a partner if satisfactory. Specializing in sewers, waterworks, and roadwork. When applying, please state age, graduation, references, salary expected, and full particulars, to File No. 4232-V.

BRITISH FIRM specializing in reinforced concrete and structural steel design requires Canadian born Civil Engineer representative in Canada. Age 26 to 45, salary $8,000. to $12,000. according to age, and experience. Selected applicants will be interviewed in Toronto, 1st. to 10th. May; Montreal 12th. to 20th. May and Ottawa 21st. to 25th. May, 1952. Apply to File No. 4233-V.

MECHANICAL OR CHEMICAL ENGINEER with a minimum of one year's experience in the mechanical or chemical engineering branches. The position to fill is that of sales engineer and field representative. Considerable travelling will be involved in all parts of Ontario and Quebec, and occasionally in other provinces and the U.S. The work will involve following up inquiries, preparing and submitting quotations, assisting customers in engineering design, and negotiating engineering details of orders and contracts. The base of operations will be from Head Office in Ontario. Apply to File No. 4234-V.

JUNIOR ELECTRONICS ENGINEER for work on HF Transmitter. Location Montreal. Apply to File No. 4235-V.

Situations Wanted

ENGINEERING ASSISTANT to manager or president with 14 years of industrial experience and shop practice in mechanical, aeronautical and civil engineering. Knows well welding, internal combustion engines, jet propulsion, nucleonics, skilled in mathematics and physics, has personality and know how experience. Bilingual, 40 years old, married; M.E.I.C., M.A.S.M.E., P.Eng. University graduate. Apply to File No. 140-W.

ASSISTANT CHIEF ENGINEER

Large and progressive company manufacturing pulp and paper products offers excellent opportunity for assistant chief engineer. Will be located in Ontario. Work includes development, design construction and maintenance on multiple plant basis requiring extensive experience. Salary in line with responsibility.

Reply in confidence giving full details to File No. 4259-V.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., middle thirties, married, veteran, eight years diverse experience; control laboratory chemist, inspection, installation, production, development, and research. Presently employed on practical research problems in corrosion and heat transfer. Apply to File No. 297-W.

CIVIL ENGINEER, M.E.I.C., university graduate, 22 years experience abroad and in British Government service in layout design, field supervision of railways, roads, buildings, water supply, drainage, soil mechanics, erosion control, contour survey, mapping, triangulation. 3 years in Canada as chief of survey-parties, resident engineer on National Defence Work, factory construction, railway, road location survey, lines and grades, estate survey, quantity take-off, re-inforced concrete foundations. Married, bilingual, veteran C.R.E., desires progressive position as chief of survey or assistant to senior executive where experience may be utilized combined with aptitude for organization. Suitable recommendations from employers available. Apply to File No. 489-W.

CHEMICAL ENGINEER, McGill University, 1950. Presently employed in U.S. doing design and production work. Would like to return to Western Canada. Desires position in production and process. Apply to File No. 1467-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., married, desires change to a permanent position leading to increased responsibilities and greater opportunities. 8 years experience in light and power design layouts for industrial plants, job instruction and plant operation. 7 years experience in electric utility power plant and substation design, cost estimating and accounting, equipment specifications and contracts, and business administration. Western Canada or Ontario preferred. Apply to File No. 1632-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec, Technical College, Stuttgart, 1924, about 18 years experience in Canada in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area preferred. Apply to File No. 1862-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Ontario. Age 45, married, 3 children, desires responsible and supervisory position preferably in the plant engineering field. Has broad experience in construction, machine design and

layout, maintenance and supervision. Prefers a location in Southern Ontario. Apply to File No. 1997-W.

ENGINEER MECHANICAL, interested in position offering opportunity as representative, plant or assistant engineer. Experience includes twelve years design, construction and maintenance with pulp and paper industry. Age 40, married. Apply to File No. 2642-W.

MECHANICAL ENGINEER, Canadian, age 37, B.Sc., M.E.I.C., P.Eng. (Ont.), 14 years experience in various phases of mechanical engineering, presently employed in a senior engineering capacity, seeking a position (preferably, if possible, in Canada) in which proven design and administrative abilities, plus hard work, allows scope for further advancement. Please apply to File No. 2745-W.

CHEMICAL ENGINEER, M.E.I.C., McGill, age 32, married. Business administration training. Experience includes: management, supervision, sales, production, research, development and control. Synthetic resins, protective coatings, building products, fermentation, detergents, acids, explosives. Organic and inorganic chemistry. Bilingual. Presently employed. Apply to File No. 2850-W.

PROFESSOR OF CANADIAN UNIVERSITY, M.E.I.C., P.Eng., Ph.D., specializing in mechanical and industrial engineering, available for summer assignment between May and September. File No. 2929-W.

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

MECHANICAL ENGINEER, graduated 1947. Four and one half years experience in maintenance, installation and production. Desires production work with small Montreal manufacturing firm. Apply to File No. 3208-W.

THREE ENGINEERS, (Grads., London) with an average of three years experience in aeronautical and mechanical engineering, desire part time work in structural, mechanical or aeronautical detailing, and stress analysis, for evenings and Saturdays, in the Toronto area. Apply to File No. 3337-W.

MECHANICAL ENGINEER, McGill, 1940, M.E.I.C., P.Eng., Quebec. Presently employed in an executive capacity seeks senior position with progressive firm. Experience includes maintenance, plant layout, machineshop, manufacturing, administration and five years as works manager of large engineering plant. References. Apply to File No. 3355-W.

CIVIL ENGINEER, B.Sc., University of New Brunswick, 1949, Jr.E.I.C., age 24, single, 2 years Canadian Hydrographic Service. 7 months as field engineer on construction work. Desires position on construction work, but will consider others. Available on short notice. Apply to File No. 3429-W.

ENGINEER, EXECUTIVE, M.E.I.C., B.Eng., P.Eng., (Que.), 25 years varied experience, administration, planning and direction of design and construction, dams, earthwork, runways, roads and streets, waterworks, sewers, sewage plants, buildings, power plants. Initiative and ability to organize effectively. Good knowledge of accounting and legal aspects of construction. Desires partnership in consulting firm or opportunity in construction business where experience will be of value. Apply to File No. 3511-W.

FULLY QUALIFIED MECHANICAL ENGINEER, M.Sc., Ph.D., P.Eng., M.E.I.C. Metallurgical Statistician fully experienced in steel production and steel products. Held top ranking positions in research and industrial development in Europe. Desires position in a Canadian organization able to offer opportunity to use considerable experience. Suitable recommendations from present employer available. Apply to File No. 3521-W.

ENGINEERING ELECTRICAL AND MECHANICAL, employed in Scotland, wishing to settle in Canada, invites employment offers, where drive will bring advancement. Associate member Institution Electrical Engineers, University London inter B.Sc., Mechanical. 5 years works apprentice, welding, machine and assembly depts. 6 years drawing office, 12 years senior appointments in production control and factory management. Experienced in production planning, factory loading, stock control, job methods, rate fixing, factory pricing, mass/batch production and budgetary control. Excellent health, 40 years of age, married, two children. Bilingual. References obtainable from Canadian and U.K. executives. Full career details and photograph on application. Apply to File No. 3610-W.

CIVIL ENGINEER, specializing in steel construction. 15 years experience design and construction of mill buildings, industrial and chemical plants, foundations, etc. Some experience of reinforced concrete design also. Past 3½ years senior design engineer with large hydro-electric utility, designing power plant structures, pipe lines and penstocks, switching stations and foundations. Member E.I.C., A.S.C.E., etc. Apply to File No. 3702-W.

CIVIL ENGINEER B.Eng. (McGill, 1949), P.Eng., Jr.E.I.C., age 25, married. Four years experience on reinforced concrete design and construction, transmission line surveying, tower design and manufacturing inspection. Desires position with consulting engineering firm in Montreal area. Apply to File No. 3845-W.

THIRD YEAR student in Civil Engineering at the University of British Columbia would like a position with consulting or contracting engineers during the coming summer. Speak and write: Greek, Arabic and get along with French. Age 22 and will be available on May the 15th, 1952. Apply to File No. 3840-W.

CHEMICAL ENGINEERING STUDENT (third year), S.E.I.C., 22, desires suitable summer employment. Good experience more important than remuneration. Applicant has had limited experience in vegetable oils. Available in early May for four months. References supplied on request. Apply to File No. 3847-W.

CHEMICAL ENGINEER University of Toronto, 1950, Jr.E.I.C., member A.P.E.O., age 22, single. Two years industrial experience in the production of sandpapers and development and control work in the production of protective coatings and allied products. Desires position with firm, preferably in the Toronto area, where hard work and initiative will bring advancement. Available immediately. Apply to File No. 3848-W.

MECHANICAL ENGINEER, S.E.I.C., Manitoba, 1951. 5 years apprenticeship in the railway industry, 2½ years mechanic in the R.C.A.F., age 28, single. Desires position in the Industrial engineering field offering the opportunity for training and advancement. At present working on research problems in the railway mechanical field. Ontario or Western Canada preferred. Apply to File No. 3852-W.

ELECTRICAL ENGINEER, McGill, 1950, Jr.E.I.C., test course graduate of large electrical firm with experience in design and related production problems. Desires position of increased responsibility with progressive organization. Married with two small children. Apply to File No. 3859-W.

SPARE TIME WORK: Civil Engineer, M.E.I.C., seeks spare time design work instructural steel, reinforced concrete or prestressed concrete, Toronto area. Apply to File No. 3860-W.

CONSULTING ENGINEER now established in the Maritimes is desirious of representing engineering or sales engineering firms in the four Maritime provinces. Graduate civil engineer, M.E.I.C., well known by engineering people and travels throughout the area. 48 years of age. Apply to File No. 3861-W.

MECHANICAL ENG., D.L.C., Jr.E.I.C., British Grad. 1948, single. Familiar with workshop processes. 18 months hydraulic research and tests in Canada. Seeks responsible position. Location irrelevant. Available on two weeks notice. Apply to File No. 3862-W.

ASSOC. MEMBER INSTITUTION of mechanical engineers (Britain). Dipl. Eng. (Warsaw University), naturalized British subject, age 45 with 20 years experience in development of various types of high speed internal combustion engines (carburettor, petrol-injection, diesel, super-charged, etc., from 20 to 1,000 H.P.), at present chief Research Engineer in a large motor manufacturers in G.B., desires position in Canada. Knowledge of French. Apply to File No. 3863-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., 3 years experience in reinforced concrete design, knowledge of prestressed concrete, also structural steel, desires responsible position with possibilities of advancement with a construction firm in Montreal. Available on 2 weks notice to present employer. Apply to File No. 3864-W.

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., B.A.Sc., University of Toronto, 1948, 3½ years design experience in the pulp and paper industry. Plant layout, maintenance and general engineering. Presently employed. Desires a position with opportunity of advancement. Age 28, married. Southern Ontario, Toronto area preferred. Apply to File No. 3865-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., Ontario, B.A.Sc., University of Toronto, 1946, seeks foreign employment in construction field. Experience includes field work in surveying and heavy construction, particularly the erection of steel structures, and office work in all phases of detailing, designing, estimating, and erection of steel structures, as well as general plant layout, reinforced concrete and timber design. Particularly interested in problems of management in engineering enterprises. Married, available September, 1952. Apply to File No. 3866-W.

STRUCTURAL ENGINEER, M.E.I.C., P.Eng., (Alta. and Sask.), B.Sc. (Civil), Manitoba, 1947, age 29, married, no children. Presently suitably employed but seeking position with firm of architects or consulting engineers in Vancouver. Available 2 months notice. 5 years experience in all types of construction in steel, reinforced concrete, and timber. 3 years in complete charge of design of multi-storey office buildings, warehouses, schools, etc. Responsible for all phases of construction from foundations to superstructure. Desires responsible position as senior designer. Apply to File No. 3867-W.

MECHANICAL ENGINEER. P.Eng., M.E.I.C., married, presently employed. Six years service in pulp and paper industry. Supervising experience and ability to organize. Familiar with mill maintenance and repair work, mill construction, budget and planning. Three years as engineer officer afloat in R.C.N.V.R. Would like responsible position in industry with opportunity for advancement. Apply to File No. 3870-W.

MECHANICAL ENGINEER, M.E.I.C., widely experienced in design of material handling equipment, cranes, crane runways and structural steel, willing to take short term contract with any firm planning a material handling system for their own plant. Will undertake design, field work, estimating and installation. Apply to File No. 3872-W.

CHEMICAL AND METALLURGICAL ENGINEER, M.A.Sc., Jr.E.I.C., U. of Montreal, 1947-1948, married, bilingual, with research and development experience in heavy chemicals, plant design and installation. At present employed with the Govt. of Canada in the chemical treatment of radioactive ores. Has gained experience in the electrochemical field and has supervised field installation of large chemical and metallurgical plant. Desires greater responsibilities in research or production within the expanding Canadian industry. Apply to File No. 3873-W.

BRITISH ENGINEER, 35, married, B.Sc., A.M.I.M.E., P.Eng., (mechanical and industrial), worked as: research, development, consulting engineer, experience: combustion, heat exchangers, fuels, refractories, instruments, furnaces, mechanical handling, welding, machine design, plan lay-out, cost evaluation; proved administrative and organizing ability, desires responsible position. Available at one month notice. File No. 3885-W.

SALES ENGINEER, Jr.E.I.C., P.Eng., B.Sc., from M.I.T. in 1951 in chemical engineering. Engineering education includes business and economics, experience includes industrial and mechanical sales to the expanding construction and chemical industries. Desire chemical or mechanical sales position with opportunity and future. Presently located in Montreal but willing to travel. Apply to File No. 3886-W.

CIVIL ENGINEER, B.A.Sc., M.S.E., M.E.I.C., R.P.E., desires position as City Engineer of City Commissioner Is twenty-nine years old, Member of Provincial Board of Health, Member of Technical Committee Revising National Building Code, a Director of Division of Sanitary Engineering, a Director of Western Water and Sewage Conference, and a Lecturer at University. Wide experience in design and financing of municipal utilities. Proven ability in Public Relations. Initiative shown by recent technical publications, school for municipal engineers and foreman, reduction of municipal fire insurance rates, activity in community planning, etc. Will not be available for service until August, 1952, at earliest, but can make arrangements to visit city and discuss position beforehand. For further particulars apply to File No. 3892-W.

GRADUATE ELECTRICAL ENGINEER, M.E.I.C., P.Eng., also graduate of the General Electric Test Course experienced with Public Utility problems, especially administration, operation and maintenance and preliminary design of Hydro Electric developments. Would consider any position leading to increased responsibility. For further information apply to File No. 3893-W.

CIVIL ENGINEER and Land Surveyor, M.E.I.C., B.Sc. (Manitoba, 1945), M.L.S. (1947), age 28, seven years experience in higher surveying, base line and township outlines, special surveys, subdivision surveys, checking plans of survey. Desires position in survey or city planning office or engineering office involving knowledge of higher mathematics and legal descriptions. Available on one month's notice. Apply to File No. 3894-W.

CHEMICAL ENGINEER, 1951 graduate, 31, single. Sixteen months research in wood chemistry, one year production control and technical service on phenalic and area synthetic resins. Desire position with organization with a good training plan, or as an assistant to an experienced engineer. Apply to File No. 3895-W.

MINING ENGINEER, B.Sc., Jr.E.I.C., three years of experience. Presently employed. Desires position in mining in the Province of Quebec. Apply to File No. 3896-W.

CHEMICAL ENGINEER, University of Alberta, 1949 graduate, war veteran, married, 36 years old. Employed since graduation as assistant to chemical engineer supervising operation of large municipal water treatment plant employing cold process line soda softening and boiler water treatment in allied 60,000 KWH. high pressure power plant. Available on two months notice. Apply to File No. 3897-W.

TWO MECHANICAL ENGINEERS, S.E.I.C., desire part time work, evenings and weekends. Estimating, designing, drafting. Apply to File No. 3898-W.

MECHANICAL ENGINEER, M.E.I.C., age 37, married, 3 children. Experience in production and maintenance of mechanical equipment and also sales and service of automatic controls. Speaks and writes both fluently French and English. Presently has own company. Desires responsible position as assistant to senior executive, requiring methodical thinking and the ability to get on well with those above and below him. Would also consider sales engineering offer. Apply to File No. 3899-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., desires part time employment in Montreal for evenings and weekends. Detail design, draughting, tracing. Experience, maintenance of diesel engines, detail design and draughting in centrifugal pumps, tracing of piping layouts and power plant installations. Apply to File No. 3900-W.

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

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.Sc. (Dal. '40), B.E. (N.S.T.C. '43), business correspondence course, age 36, married, one child. Interested in maintenance and distribution with utility or medium size company with an opportunity to work into administration position. Experience includes four summers dockyard expanding electrical system, one summer Arvida construction, test course, three years consulting firm—heating, lighting, electrical and plant layouts and cost systems, four years hospital and X-ray maintenance in China. Available immediately. Apply to File No. 3901-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950, University of Saskatchewan graduate. Married, veteran, age 27, one year of industrial design and draughting experience. Presently employed in Eastern Canada but interested in mechanical engineering openings in the province of Alberta. Available on short notice. Apply to File No. 3902-W.

MECHANICAL ENGINEER, S.E.I.C., (N.S.T.C., '51), age 23, single. Employed four summers while undergraduate with manufactured gas company. Since graduation have been employed with a small prepane bulk plant. Desire change of work, will consider anything. Available on short notice, no location preference. Apply to File No. 3903-W.

MECHANICAL ENGINEER, University of B.C., 1948, wishes to relocate in or near Vancouver. Four years experience in design, layout, and installation of light and heavy machinery; production problems; and development engineering. Will be available for interview in Vancouver late June. Apply to File No. 3904-W.

ENGLISH CHARTERED CIVIL ENGINEER, A.M.I.C.E., age 43 years, married, one child, at present chief assistant engineer to county surveyor in England, seeks similar appointment in Canada with Provincial or Municipal authority. Wide experience in surveying, design, construction and maintenance of: steel and reinforced bridges and structures; highways, general civil and municipal engineering and administration. Five years commissioned service with Royal Engineers in U.K., India and Burma. Apply to File No. 3905-W.

LANDSURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of landsurveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. Apply to File No. 3908-W.

CIVIL ENGINEER, 1933 graduate, married, with car, 19 years experience (about a year in Canada) on design, erection and maintenance of mill buildings, chemical plants, apartment buildings, hospitals, highways, etc. Desire position in construction or work closely allied thereto. Presently employed, will be prepared any time after June 15th. Apply to File No. 3920-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M.I.E.E., age 29, married, recently arrived from England and presently employed in the Maritimes. Experience: 5 years trade apprenticeship on dock and harbour installations, 4 years D.O. work including layout and estimating power and lighting projects, 4 years full time lecturer, 1 year sales and contracts with large manufacturer, and 1 year supervising maintenance of amplidyne controlled diesel-electric plant. Seeking position as a senior assistant with prospects of advancement in developing industrial or municipal undertaking. Apply to File No. 3922-W.

INDUSTRIAL AND MANAGEMENT ENGINEER, B.A.Ss., U. of M., M.E.I.C., age 35, married, bilingual, thoroughly experienced in all phases of industrial and commercial organization and management. Background includes highly successful consulting work in a large number of companies. Desire responsible position with medium firm located preferably in Montreal. Apply to File No. 3923-W.

JUNIOR EXECUTIVE, age 31, married. Bachelor of arts and Bachelor of Applied Science degree in civil engineering. Practical experience in surveying road and railroad construction, timber bridge and wharf design and construction. Very familiar with construction and logging methods and machinery. At present employed by British Columbia logging company in supervisory position in charge of a logging operation. Would take position with a company with openings in technical sales or as assistant to management. Able to take responsibility of a position requiring organizing and administrative experience and ability. Apply to File No. 3924-W.

PROFESSIONAL ELECTRICAL ENGINEER, 40 years, British, seeks position in Canada. Toronto, or Southern Ontario preferred. Higher and ordinary National Diplomas in Electrical Engineering, with distinctions. Corporate member of The Institution of Electrical Engineers. 9 years as draughtsman, 12 years as executive engineer with electricity supply authorities on distribution and commercial activities. 3 years with British Air Ministry (Seconded). Apply to File No. 3925-W.

CIVIL ENGINEER, University of Saskatchewan, 1951, Jr.E.I.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

CIVIL ENGINEER, age 27, recent immigrant, 1st class honours B.E. degree, National University of Ireland (1950), D.I.C. for postgraduate course in the theory and design of structures at Imperial College, London, England. Some experience in surveying. Presently employed at the design of buildings and other structures required for mining plants. Desires position which would give him some experience in reinforced concrete or steel design or construction. Location preferably Toronto or Montreal, but will also consider others. Apply to File No. 3927-W.

GRADUATE CHEMICAL ENGINEER of Delft Technical University (Netherlands), 1942. Eight years experience in petroleum refining. Presently unemployed. Married, 2 children. Planning to settle in Canada. Interested in any position in oil industry preferably petro chemical branch. Prefer Toronto area. Also interested in other industries. Speaks, English, French, Dutch, German and Spanish. Apply to File No. 3929-W.

METALLURGICAL ENGINEER, Jr.E.I.C., age 28, single. One year's experience with electric furnace steelmaking and one year with melting department of magnesium and aluminum foundry. Interested in research and development work. Available by June 15th. Apply to File No. 3930-W.

PLANT ENGINER, Mechanical, Queen's, 1944, M.E.I.C., 1947, six years with small food processing plant, wants position assistant or plant engineer with larger company. Experience comprises operation and maintenance of L.P. boiler, elevator, air conditioning and drying equipment, freon and ammonia cooling systems. Also responsible selection layout and erection of new ammonia plant, chemical dehumidifier, and independent design of new type drier. Salary five thousand or more depending on location and permanence. Available about three months' notice to present employer. Preferred location central Canada or U.S.A. Apply to File No. 3935-W.

ELECTRICAL ENGINER, M.E.I.C., P.Eng., graduate University of Alberta, 1949, married, veteran, 31, presently employed by public utility as underground distribution and relay engineer, desires position in Alberta. Previous experience in radar, and with heating and ventilating contractor. Would welcome position with responsibility. Interested in working into management position. Apply to File No. 3938-W.

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Ductile Iron was selected by Cockshutt Farm Equipment Co. Ltd. as a die materia over other cast irons available, for servic where severe forming was encountered, be cause it offered much superior mechanica properties with at least equal machinability at the same hardness range. Standard "as cast" ductile iron in medium section may b expected to meet ultimate strength an yield point specification values of 90,00 p.s.i. and 60,000 p.s.i., respectively. In ad dition the iron has a measure of ductility and a considerably higher resistance to im pact than has cast iron. The new engineer ing material can be flame hardened afte machining if increased wear resistance i desired. It can also be welded. For ad ditional information on Ductile Iron, sen the coupon.

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NAME .....

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News of the Branches

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

Cornwall

JOHN A. SARJEANT, JT.E.I.C.,
Secretary-Treasurer

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

April Meeting

Three Cornwall Branch members gave brief addresses at the April meeting of the branch, held in the assembly room of Courtaulds (Canada) Limited on April 8.

R. L. Blackett, M.E.I.C., production superintendent of the local Dominion Tar & Chemical plant, spoke on the manufacture of fibre conduit and allied products. He outlined the various processes and described the machines employed in the production of fibre conduit, also, outlining the various uses of the conduit and pipe. N. F. Gordon, S.E.I.C., introduced Mr. Blackett.

F. R. Warner, M.E.I.C., assistant superintendent of the Ontario-St. Lawrence Canal System, spoke on year around maintenance of the system and outlined several of the major problems encountered in this work. He was introduced by J. E. Pescod, JT.E.I.C.

F. R. Leggett, head of the instrument department at Courtaulds (Canada) Limited, outlined the principles of automatic control and maintenance of industrial instruments. He was introduced by John Morris, M.E.I.C. and concluded his address with films showing various maintenance procedures.

B. T. Yates, chairman of the local branch, outlined the programmes planned for future meetings of the branch at the conclusion of the meeting.

Calgary

C. E. MCNEVIN, M.E.I.C.,
Secretary-Treasurer

FRANK TEMPEST, M.E.I.C.,
Branch News Editor

Annual Meeting

The annual meeting of the Calgary Branch of the Institute was held immediately after a dinner held on Thursday, March 6 at the Club Cafe.

Owing to the comparatively low attendance at the annual meetings of the last few years, the Executive proposed that this year's meeting be preceded by a Branch dinner. The success of this idea was proven by the presence of eighty members at the dinner and meeting.

Following a very enjoyable and friendly dinner a recess was declared by Chairman H. R. Hayes, while the tables were cleared.

Mr. Hayes opened the meeting by calling on each standing committee chairman to say a few words with respect to his report, previously mailed to each member, and to answer any questions that might be asked.

The Branch Chairman then introduced the newly elected Executive and wished them well in their endeavours.

T. D. Stanley has been elected Branch chairman; C. E. McNevin is secretary-treasurer. Members of the Executive Committee are H. M. Hunter, N. H. Lukes, and G. H. Galbraith. Auditors are T. M. Schulte and C. W. Coote. Ex-officio officers are J. J. Hanna, R. T. Hollier, H. R. Hayes and D. C. Jones.

In welcoming the new executive one member of the Branch stated that the work required of the secretary treasurer was getting beyond the scope of a one man job, and suggested that the new executive explore the advisability of having a secretary and treasurer elected for each position.

As a last item of business for the retiring executive Mr. Hayes announced that Mr. Ira Macnab, president of the Institute would be in Calgary on April 22. Mr. Macnab will stop off here on his way to the general meeting to be held in Vancouver. The speaker of the evening Dr. James Fowler was then introduced to the assembly.

Dr. James Fowler, principal of the Provincial Institute of Technology and Art, gave a most interesting address on the subject of **Scottish Wit and Humour.** He quoted—"A little nonsense now and then is relished by the wisest man."

Wit, which is a product of the sharp minded, is the faculty of associating ideas in a new and amusing way, whereas humour is a mental quantity which gives ideas a ludicrous and fantastic turn. Wit, he said, is a product of the mind, while humour is a kindly feeling from the heart.

The Scots are too analytical to be particularly witty, but they have a fine sense of humour with a genial warmth. They like nothing better than to make fun of things usually associated with their own national character such as thrift, the church and its ministers, Whiskey and Scottish canniness.

All in all a lively, humorous address.

Halifax

W. E. JEFFERSON, M.E.I.C.,
Secretary-Treasurer

J. P. DUMARESQ, M.E.I.C.,
Branch News Editor

Supper Meeting February

Mr. Hornstein, who is chief meteorologist in charge of the Halifax Weather Office, addressed a meeting of the Halifax Branch on Thursday, February 21, 1952. The attendance at the meeting was 70.

Mr. Hornstein was introduced as the "Weather Man" who broadcasts every Sunday afternoon and in starting his talk he warned his listeners that what they would learn this evening would not be much help in determining Halifax weather for the next few days. It is extremely true that dynamics forms the most important factor in respect to atmospheric conditions. There are many problems in the dynamics of the atmophere but there are two variables, (1) the temperature and (2) the moisture content of the air. These two variables vary with relation to one another over a wide region and the solution of the two variables gives the daily weather broadcast. The motion of the air is either horizontal or vertical. There are large source regions from which air moves, one in the far north where the water content is low because of the extra cold and one in the South Atlantic near Bermuda where the air is warm and moist. In hot regions the air becomes lighter and rises, thus allowing cold air to move in. As the air rises, changes take place giving condensation and rain thus accepting or releasing energy. The weather charts must be on a three dimensional basis giving the state of the atmosphere at various levels. First, kites were used to chart the higher atmosphere, then aeroplanes and finally, hydrogen-filled balloons with meterograph equipment and a tiny transmitter which sends signals giving the weather conditions that exist in the atmosphere through which the balloon is passed. This gives a reasonable vertical picture of the atmosphere and its stability. Warm air over cold is stable while the reverse is unstable. Local heating sets off thunder storms.

Weather information is vital to the operation of aircraft but weather conditions are never static so the information obtained is not always true by the time it is plotted and when the flight is finished. It is customary to draw charts for various slices through the atmosphere, 10,000 ft. and 18,000 ft. are usual, but 32,000 ft. to 35,000 ft. is used during the hurricane season. These

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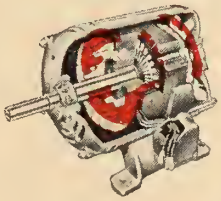
Life-Line's improved insulation lessens chance of burnout. Special synthetic resin insulation on the windings, chosen for Life-Line Motors, can be twisted bent or hammered without damage! The insulation materials and the shape of stator slots illustrated have been redesigned for greater electrical strength.

Service records show that improvements built into Westinghouse Life-Line Motors cut in half the possibility of motor failure.

Westinghouse actually developed a new method of making motors to give you all these desirable mechanical and electrical features . . . . a motor that stands rough handling, cuts down burn-outs, needs no regreasing, is lighter, more compact, better looking and smoother running!



For immediate delivery of popular sizes, or discussion of your requirements, call the nearest office of Canadian Westinghouse Company Limited.

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• high resistance to moisture, acids and alkalis • chemically inert • fatigue resistant • flexibility

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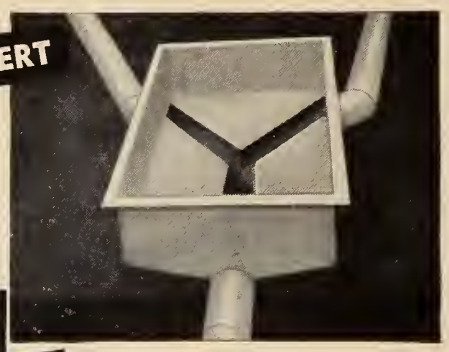

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Polythene makes possible the "squeeze" bottles used for deodorants and a variety of other liquids. It retains flexibility even at sub-zero temperatures.

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charts are much like the charts at earth surface excepting that they are simpler because many low pressure areas do not extend up.

Jet streams in the atmosphere are a very recent discovery. Observations have been made of wind speeds of 125 miles per hour even with normal wind speed of 40 miles on each side. These reports were discounted and looked upon as errors. However, when reports of aeroplane flights were chartered it was found that some tail winds were made up of these jets of air and were flowing at speeds as great as had been observed.

The upper air charts and the surface charts are used in daily weather forecast and by learning the relation between them it should be possible to tell where air will go. Stream-lines on the surface carry a relation to the streamlines of the upper charts. The big difficulty at present is lack of knowledge and this results in different solutions being worked out by different people to cover the same period of time.

The weatherman should tend to become pessimistic but most of them are not. The service they provide is economically valuable and will increase in value as time goes on. A long term forecast is not practical and one of the difficulties is the time required to complete calculations on the information collected during a normal working day.

In answer to questions, Mr. Hornstein stated that it was easier to forecast over marine areas than over land, except for the fact that fewer reports are received at sea and some sea reports are faulty due to defective instruments. The balloons used in operation are sent up twice daily at 11 a.m. and at 11 p.m. from approximately 30 stations in Canada. United States uses the same frequency but has more stations. England uses four daily. Usually the balloons burst at 5,000 ft. and the equipment returns to the earth via parachute but is seldom recovered.

The Chairman expressed the thanks of the meeting to the speaker at the conclusion of his talk. He extended a special welcome to Mr. F. W. W. Doane on his recent election to honorary member of the Institute.

Supper Meeting March

The March supper meeting of the Halifax Branch was held on March 20 with the Chairman, Mr. W. J. MacDonald presiding. Approximately 60 members attended. Dr. H. D. Smith, president of the Nova Scotia Research Foundation, spoke on the progress and the functions of the Foundation in the fields of scientific and industrial research.

Dr. Smith pointed out that the Foundation originated in 1946 having as its main purpose the co-ordinating, promotion and the general carrying out, with the co-operation of industrial organizations, of scientific and industrial research on behalf of the Province of Nova Scotia. He stated that research is going on in the fields of lumbering, fishing, mining, agriculture and education. It has been provided by the legislature under which the Foundation was set up, that it may at its discretion build, equip and staff laboratories and libraries for the efficient performance of its work. To this end the Foundation has worked in close co-operation with the Provincial and Federal Government departments, industries and the universities and colleges of the Province.

During the five years of its existence

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GRINNELL, ALONE, MANUFACTURES A FULL LINE OF HANGERS AND SUPPORTS

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In its modern, well-equipped laboratory, tests are constantly being made to discover better ways of solving old and new pipe suspension problems.

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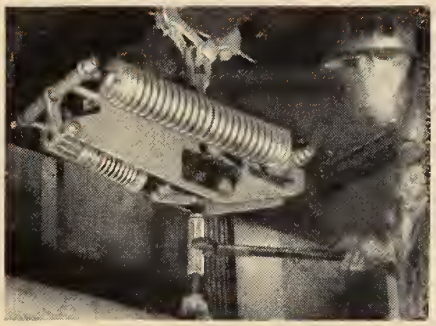
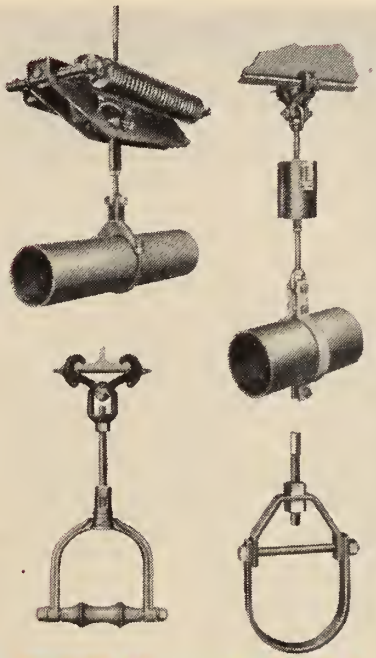
Grinnell's Pipe Suspension Department makes available specialized knowledge in the computation of hanger loads and the selection of the correct supports. No other company can match this service.



GRINNELL, ALONE, OFFERS EXPERIENCED FIELD ENGINEERING ON "TOUGH" JOBS

Grinnell maintains an experienced staff of engineers in the field . . . ready to assist you "on the job" with any problems in the erection of pipe hangers and supports, no matter how complex.



Grinnell makes scientifically designed, ruggedly built pipe hangers and supports for every type installation.

Pipe suspension presents an extremely wide range of problems involving weights, stress, thermal movement, materials and specialized engineering. No one "goes into" the pipe hanger business overnight. Large manufacturing facilities, skilled technicians, and a lot of down-to-earth practical experience are needed.

Grinnell has become Canada's No. 1 supplier of pipe hangers and supports only because Grinnell has specialized in piping for one hundred years. Grinnell has developed a line of pipe hangers and supports for every piping requirement.

Grinnell is always ready to co-operate with engineers and architects in the preparation of pipe suspension specifications.

Call Grinnell for any and all types of pipe hangers and supports.

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GRINNELL COMPANY OF CANADA LTD., Montreal • Toronto • Vancouver • Grinnell Jobbers in Principal Cities

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • valves • Grinnell-Saunders diaphragm valves • pipe • prefabricated piping
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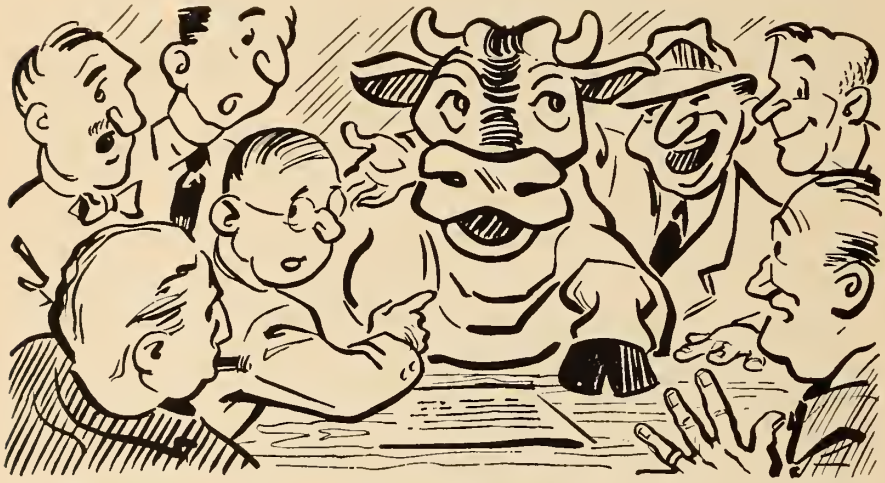
the Foundation has worked in close co-operation with research bodies in other countries, particularly so with the Research Corporation in New York City and governmental agencies in Washington as well as various research groups in Great Britain.

Dr. Smith went on to say that at present many of the active research groups now in operation are supervised by professors of sciences in the various colleges in Nova Scotia, and that the facilities of these colleges are placed at the disposal of research groups.

He also stated that at the present time a programme of geophysical research is being conducted by the Foundation in Nova Scotia. This study is concerned with possible techniques of applied geophysics that may be useful in the solution of specific geological and mining problems presenting themselves in the Nova Scotia coal fields particularly.

Research groups are also probing into the seaweed, sheep, poultry and the apple industries. With the aid of provincial and federal groups, experiments are also being carried on with the close co-operation of industrial and university groups.

Dr. Smith also told members of the Institute of the excellent facilities of the Foundation such as libraries, etc., available to them at any time. Following his very eloquent and enlightening address, Dr. Smith answered questions put to him from the floor.



THE COW
at the council table

The Reeve and Council were startled, but Jim explained.

"Lactic acid from spilled milk is playing heck with my barn floor. I've brought Bessie along to bear me out."

"Moo-oo-oo!" said Bessie, meaning "You're darn right."
"Battery acid is doing the same to my floor,"
said Bob Harris, the garage owner.

It turned out that Tom Black, the photographer, Bill Short of the cooperative packing plant, Harry Smith, the laundry proprietor, Elmer Park of the sheet metal works, were all having acid trouble, too.

"Guess we were smart to put in Vitrified Clay Pipe for our town sewerage system," said the Reeve. "No trouble with acids or corrosive waste there! Vitrified Clay Pipe gives *permanent* protection, because it's bonded by fire, inside and out. Good investment that was, eh, Jim?"
"Moo-oo-oo!" said Bessie, meaning "You bet your life!"

VITRIFIED CLAY PIPE INDUSTRY
BONDED BY FIRE

7-2

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

Bernard A. Warren, Jr.E.I.C.,
Branch News Editor

Professional Development Meeting

At a special meeting of the Hamilton Branch Professional Development Programme, March 28, members of the group and their employers heard J. F. Wallace, Staff Officer Training, Civil Defence Headquarters speak on **Civil Defence.**

Mr. Wallace, introduced and thanked by Mr. M. J. McAuliffe, Jr.E.I.C., spoke on the three types of expected attack: Atomic and Radiation, Demolition and Incendiary, and Bacteriological; and the basic ways of avoiding casualities with methods for counteracting damage and effects of each type of attack.

The speaker, travelling from Ottawa to address the group, told of his liaison work with American Civil Defence Headquarters.

During the discussion which followed, and led by Peter Marko, Jr.E.I.C., some interesting queries and suggestions were directed to the speaker. One contribution from the floor was a suggestion that major Canadian News Services write up and have ready detailed descriptions for methods of behaviour for civilians in each of the three types of attack. This could, in case of emergency, be released to all papers and radio stations to avoid confusion and panic. The idea being that most individuals are not sufficiently interested to learn procedures until the emergency arises when it is, of course, too late.

Following discussion, G. L. Schneider, Jr.E.I.C., gave the members of the group and their employers a brief outline of the course, its history, and a brief preview of plans for the coming year.

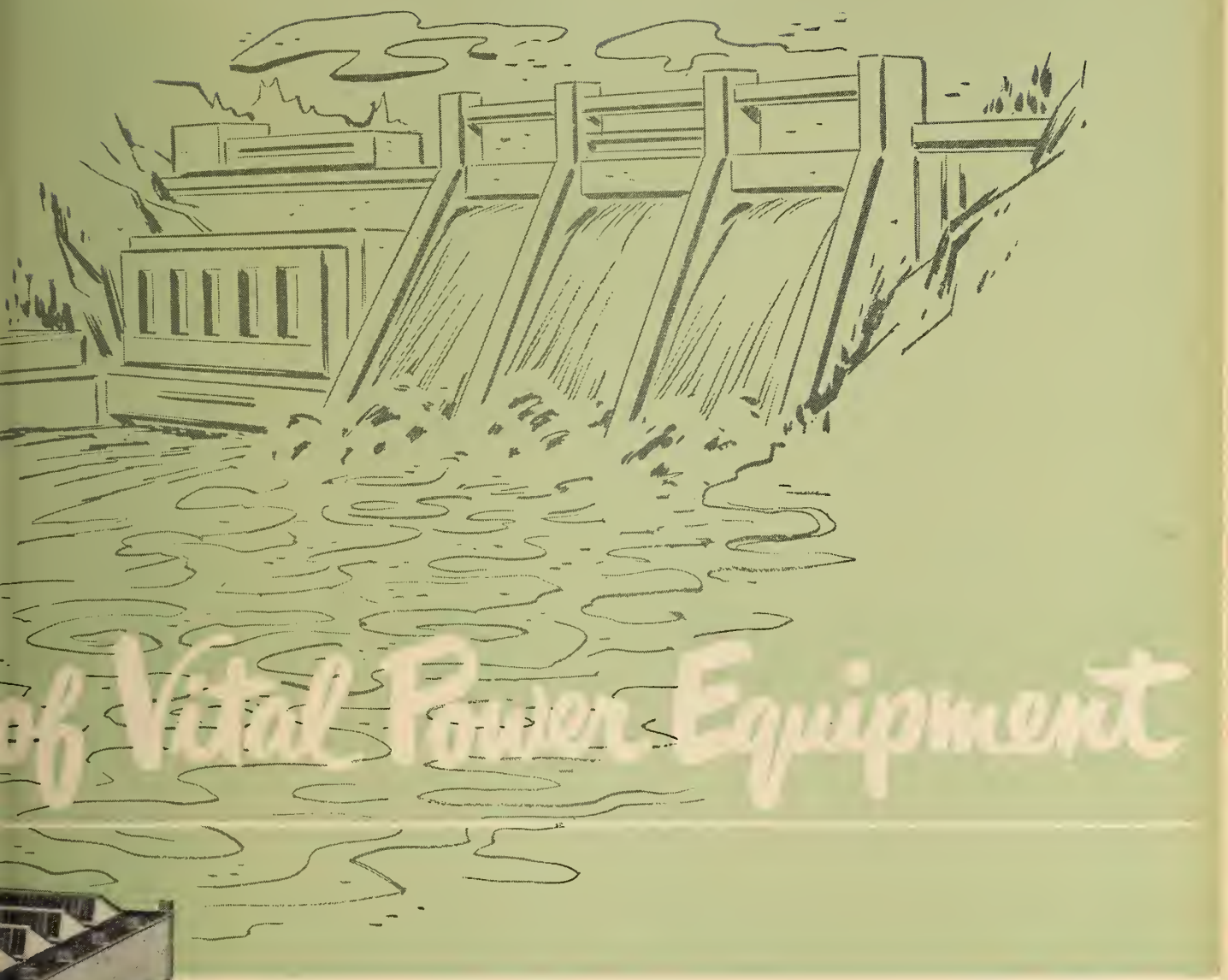
Juniors and Students Papers Competition, 1952

Following the pattern set by last year's competition, the 1952 Hamilton Branch Juniors and Students Papers Competition was keenly contested by eight enthusiastic young men during March.

Climaxing a week's activities which, under the chairmanship of J. S. R. Beck, Jr.E.I.C., saw the eight contestants reduced to four finalists, all contestants met with members of the committee and the executive of the Branch at Hamilton's Club 222 for dinner preceding the meeting. Later in the evening of March 27, the four finalists spoke in competition to the regular March Meeting of the Hamilton Branch of the Engineering Institute of Canada.

M. J. McAuliffe's paper on **Industry and Frequency Conversion** was awarded the Past Chairmen's Prize of fifty dollars, presented on behalf of Hamilton's past chairmen by E. T. W. Bailey. Mr. McAuliffe described the great opportunity of industry to correct past accumulated mistakes and take the best advantage of replacing out-moded processes with the most modern practice. He went on to say that as industry pays only a quarter the cost of the conversion, it is their responsibility to ensure that electrical installations are not only converted but improved at the same time.

J. A. Michell, Jr.E.I.C., was awarded second prize for his paper on **Electrical Metering and Rate Structure.** Mr. Michell discussed methods by which the



Brown Boveri, one of the world's most important producers of electric and thermal power equipment, has begun production of transformers, switchboards, and air-blast circuit-breakers at its new plant located in St. Johns, Que.

Since the turn of the century, this famous Swiss engineering firm has been supplying a wide range of products to Canadian industry. Now, to keep pace with the upsurge of industrial development in a growing country, Brown Boveri is manufacturing here in Canada. In combining the experience of Swiss specialists with the skill of highly trained Canadian personnel, Brown Boveri is assuring that production will be of the same high standard of quality for which its equipment is known throughout the world.

Air-Blast Breakers

Transformers

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consumer should be required to pay a just price for their power, not only measured in terms of total kwh. supply over a given period, but also in terms of peak demand of kw. at certain times. The speaker has been engaged in the development of a watt-hour meter which measures and records these peak demands.

Winning third prize for his paper on **A Proposed Method of Locating a Fault on a Long Telephone Line** was F. S. Gue, JR.E.I.C.

Mr. Gue demonstrated the mechanism, which he developed in conjunction with Mr. Fred Longstaff in experiments along the Alaska Highway, which locates a fault within one hundred feet in a hundred mile line, or with an accuracy of 1/50th per cent. In this locality, said Mr. Gue, often wires strike obstacles or each other causing a hitting fault due to the extreme expansion and contraction over temperature changes of 170 degrees. The instrument has yet to be placed in commercial production, but its possibilities are distinct.

Receiving honourable mention was B. A. Warren, JR.E.I.C., with his paper **An Engineer Looks at Advertising.** Mr. Warren discussed the advantages which engineers in industry and private practice can obtain by the use of advertising in the marketing of commodities and services. He mentioned the programmes of the Professional Engineers Association of Ontario and Britain's Institution of Civil Engineers with regard to Public Relations, stating that a Professional Engineer should advertise his practice in technical publications covering his field.

The other four who gave papers in the preliminary competition were D. B. Williamson, JR.E.I.C., on **The Westinghouse Network Analyzer;** J. M. Skinner, S.E.I.C., **Transportation Problems in a Modern Steel Plant;** N. E. Hudak, JR.E.I.C., **Location of Faults in Power Cables by Fault Generated Surges;** and D. H. J. Kay, JR.E.I.C., **The Fraser River Model.**

Following the presentation of papers, the chairman of the Students and Juniors Papers Committee conducted a discussion period, during which the four speakers were tested on their grasp of their paper subject.

In congratulating all contestants, Mr. W. L. Hutchison, M.E.I.C., Hamilton Branch Chairman commended the work of the committee which included Messrs. D. A. Peterson and C. M. Yeates, for their efforts which resulted in such a fine evening. He also paid tribute to the work of the judges, Messrs. W. E. Brown, M.E.I.C., E. T. W. Bailey, M.E.I.C., and L. C. Sentance, M.E.I.C., in making their difficult selections.

Discussion was continued as the group enjoyed donuts and coffee.

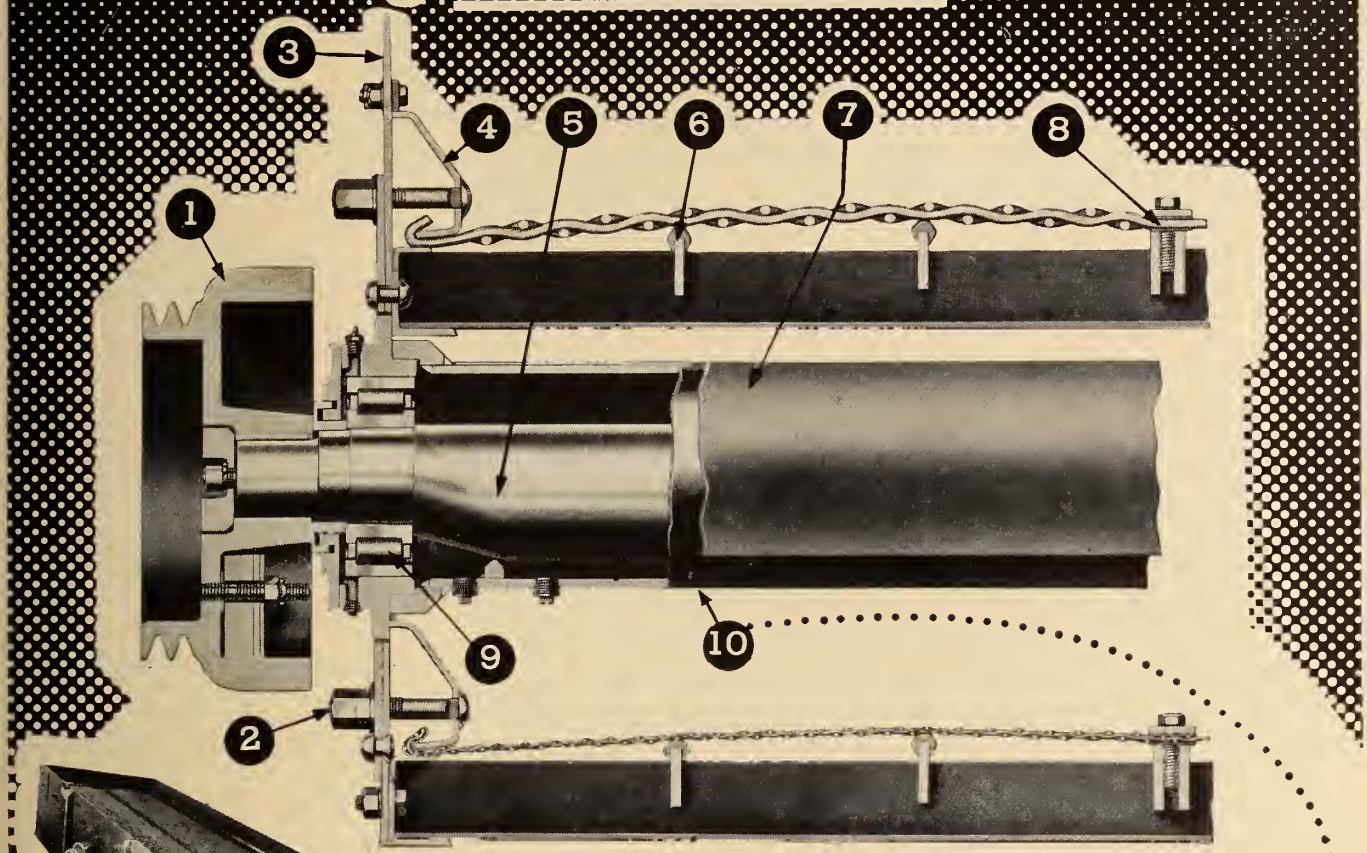
All papers have been forwarded to the Ontario Zone for Competition for the Galbraith Prize, and a written appraisal of each contestant's written and oral presentation has been made by the judges.

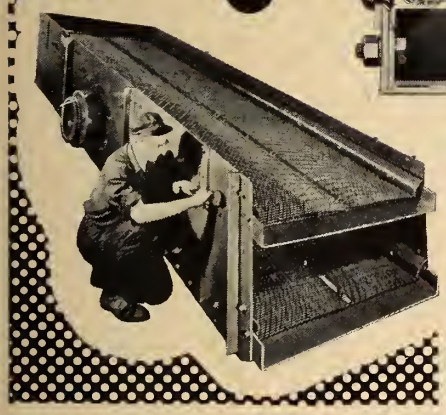
Hamilton Engineers Wives Association

The Engineers' Wives Association of the Hamilton Branch started the current year with an outline of many interesting social activities.

In February a Valentines party was held at Muirheads restaurant with husbands as guests. Numerous prizes were presented to bridge and dancing enthusiasts. On behalf of the members,

10 Big Features–10 Big Reasons For Using *RIPL-FLO* Screens





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CANADIAN ALLIS-CHALMERS

Four finalists in the Hamilton Students and Juniors Papers Competition. Left to right: B. A. Warren, F. S. Gue, M. J. McAuliffe, and J. A. Michell.

At a special meeting of the Professional Development Program of the Hamilton Branch, on March 28. Left to right: M. J. McAuliffe; J. F. Wallace, the guest speaker; W. L. Hutchison, Branch chairman; G. L. Schneider, chairman of the Program.

Mrs. James Stodart presented Mrs. G. L. Schneider, retiring president, with a gift, a token of appreciation for her fine work in office since November, 1950 when the Association was founded.

At the March meeting, Col. L. F. Grant of Toronto, field secretary for the Engineering Institute, spoke on the history of E.I.C. He emphasized some of its more serious commitments and also, the romance of the Institute since its earliest days.

At the April meeting this Association had pleasure in entertaining Mrs. I. P. Macnab of Halifax, wife of the president of the E.I.C. The audience was very fortunate in witnessing an exceptional demonstration by one of the local florists, in arranging all types of lovely floral displays. The meeting was adjourned, and was followed by a coffee hour.

The slate of officers for 1952 is as follows: Mrs. F. J. Veale, president; Mrs. P. J. McNally, vice-president; Mrs. J. A. Tyerman, recording secretary; Mrs. J. S. R. Beck, corresponding secretary; Mrs. G. L. T. Vollmer, treasurer; Mrs. R. G. Northrup, membership secretary; Mrs. J. A. Reid, programme convener; Mrs. Ira Robertson, social convener.

Kingston

S. H. Rochester, M.E.I.C.,
Secretary-Treasurer

Joint Meeting

Robert H. Saunders, chairman of the Ontario Hydro Electric Power Commission spoke at a meeting of the Chemical Institute of Canada, the Engineering Institute Kingston Branch, and the Junior Chamber of Commerce, on March 19 in Kingston.

Power in abundance—with or without the St. Lawrence development—is guaranteed industry and the people of Ontario. But even as he urged municipalities to reach out and bid for industrial expansion, Mr. Saunders warned that the days of low-cost electricity may be numbered in Ontario.

Hydro, he said, stood at the crossroads. It was demand against economics and vital decisions would have to be made within the next few months.

His capacity Hotel La Salle audience listened with rapt attention as he proclaimed that hydro was actually meeting the demand for power today without restrictions and would continue to do so in the future.

"Municipalities from Quebec to the borders of Manitoba, from the United States boundary northward can say to industry: "Come to us, we can give you power." "Go out after industry. We will supply that power," the hydro chairman pledged. "That is our position today. And that is our position tomorrow."

The vital question was whether that power was to be expensive steam-generated electricity or cheap St. Lawrence River power.

Hydro's post-war programme had risen to $973,000,000 and would take care of the province's needs with something in reserve until 1955.

"Beyond that we must prepare," the chairman said. "We must have assurance of the St. Lawrence development or carry on our programme. We won't be caught short."

A decision would have to be made within a few months on a second Niagara development and that, too, depended on the seaway.

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The United States, as power hungry as Ontario, also needed the resources of the great waterway. Without it the cost to Ontario would be $45,000,000 annually. If it was built the saving would be $27,000,000 each and every year, Mr. Saunders said.

(The $45,000,000 was the cost of generating 6,300,000,000 kilowatt hours of power by steam.)

The chairman said that St. Lawrence power could be produced at the site at a fraction of the cost of steam power, about 2.8 or three mills compared to 7.4 mills. This would not include transmission lines.

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"It's not a question of supplying the power but one of economics," the speaker emphasized. "We will give you the power in abundance but not at low cost without the seaway."

Elaborating, he said a pound of coal produced a kilowatt hour of power. In Toronto the rate was about .85 of a pound of coal per hour. In January a single steam unit operating on a five-hour day had consumed 5,200 tons of coal. The cost was $48,800 for coal alone. For a 15-hour day an expenditure of $139,000 would have been required for coal.

"Is it any wonder we at hydro are concerned about the St. Lawrence development?" he asked.

Mr. Saunders said he had travelled widely in Ontario and had seen prosperity everywhere. "This," he said, "has been declared Canada's year. I believe it's Ontario's decade. We are moving ahead. There is nothing to stop us but our own unwillingness to prepare for the future."

And Kingston would share in the great era, the speaker predicted. This city faced a marvellous future, a future that must be protected. Noting the increased demand for electricity, he said that consumption here was 68 per cent higher than it was in 1945.

In his opening remarks the chairman reviewed the progress of hydro over the past 41 years. It came into being, he said, on the demands of businessmen for low cost power and a magnificent job had been done, a tremendous asset, worth more than $1,000,000,000 had been developed and was still developing.

He paid tribute to the Kingston Public Utilities Commission for a "splendid job" in providing power at lower and

lower costs; 24 per cent less per kilowatt hour than was charged in 1938. That, he said, was an example of the whole province.

The Ontario hydro, Mr. Saunders stated, had contributed much in the building of industry, in bringing about higher standards of living and in preparing for the future.

He referred to an article in the Feb. 4 issue of Time magazine which hailed the amazing industrial development in Canada. That progress, he said, was due to the utilities that generated power, power that had brought an increase of billions in the value of manufactured products between 1939 and 1951.

In 1939, Mr. Saunders said, products were valued at more than three billions. In 1951 the estimate was better than 16 billions. The picture was the same in Ontario, an increase to about eight billions from $1,745,000,000 in 1939.

At the same time the production of power had reduced working hours and made life easier for the people.

In detailing the growth of hydro in Ontario, the chairman paid a striking tribute to the engineers of this country. There were none greater anywhere, he said, but they seemed to shun the limelight.

"Start talking, toot your own horns; take a bow," he urged. "You deserve the thanks of the people."

Canadian engineers working on hydro projects had poured concrete at 40 degrees below zero as a matter of course, Mr. Saunders said, and some below the border were still wondering how they did it.

Mr. Saunders said the per capita consumption of electric power in Ontario was 4,472 kilowatt hours. For all Canada the rate was 3,931 kilowatt hours. In the United States it was 2,095 and 1,194 in the United Kingdom.

The hydro executive said the cost of a two unit steam plant was $40,000,000; four units $67,000,000 and without the St. Lawrence development more would have to be built to meet the increasing demands of the province—and those demands would be met, regardless.

"It would be a crying shame," he said, "to be forced to give high cost power. The gifts of nature were meant for the people and it's our job to see that they are used by the people," he concluded.

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Mr. Saunders was introduced by Bogart W. Trumpour and thanked by Dr. Roy Spooner. Maj. A. L. MacLean, chairman of the local branch of the Engineering Institute, presided at the dinner.

Seated at the head table were Mr. and Mrs. Evan Jack, Mayor and Mrs. C. A. Curtis, Major and Mrs. MacLean, Mr. and Mrs. B. W. Trumpour, Mr. Saunders and Prof. Grenville B. Frost.

Tour of Canadian Locomotive Company Plant

Through the kind courtesy of the Canadian Locomotive Company, Kingston, arrangements were made for the Kingston Branch of the Institute to tour this plant on Tuesday evening, April 15, 1952.

Prior to the tour Mr. J. F. Weiffenbach, vice-president (manufacturing) addressed the 120 members and guests. Mr. Weiffenbach explained that the Canadian Locomotive Company, even though Fairbanks Morse Ltd. in the United States held shares in the Company, was primarily a Canadian organization whose success or failure depended upon its own initiative. The Company was, however, at liberty to draw on the experience and help of the American Company. They were also free to change the design of the locomotive to suit Canadian conditions.

Mr. Weiffenbach then explained the changes made to the plant in order to facilitate an even flow of materials, which is more essential for the construction of a diesel locomotive than a steam locomotive. He also said that they have purchased their last American made engine and intend making their own in the Kingston Plant.

During the time of steam locomotive manufacture, company business was up and down which made employment very unstable. It is the policy of the present management to keep employment at a more steady level by manufacturing locomotives even if they are not covered by orders. By so doing they intend to "stock" locomotives.

Following Mr. Weiffenbach's address, a conducted tour was made of the plant. Diesel locomotives and ore dressing equipment were seen in various stages of completion.

After the tour Mr. Weiffenbach answered questions raised by the members. The meeting was adjourned after Dean Ellis thanked Mr. Weiffenbach for the opportunity of touring the plant.

Lethbridge

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

J. T. Dokken, jr.e.i.c.,
Branch News Editor

March Meeting

The Lethbridge branch of the Institute held its regular monthly meeting at the Marquis Hotel on Saturday, March 22. P. E. Kirkpatrick, branch chairman presided and the speaker for the evening was Mr. W. Gray, construction engineer for the Bow River Irrigaton Project.

After some enjoyable community singing led by E. A. Laurence accompanied on the piano by A. L. H. Sommerville, the speaker was introduced by W. L. Foss.

Mr. Gray discussed the history and development of the Bow River Development up to the present. The project will cover a large triangle of land bounded by the Bow River, Little Bow and Oldman Rivers. Originally there were three parent companies: Canadian Wheatland Co., Alberta Land Co. and Southern Alberta Land Company made up of private interests who purchased land hoping to develop it and show a profit. These three companies later amalgamated to become the Canada Land and Irrigation Co. Most of the canal construction was completed between 1910 and 1914 but due to World War I and a banking failure construction was ceased before completion. As a result only a small central area around Vauxhall is irrigated at present. Due to the many years of financial difficulties construction and maintenance was held at a bare minimum. Mr. Gray paid tribute to D. W. Hays, retired project engineer, for his work in keeping the project in running order in the face of so many financial difficulties.

The P.F.R.A. bought the existing project from the Canada Land and Irrigation Co. in 1950. The P.F.R.A. work so far has consisted of repairing, enlarging, rerouting canals and completely replacing some structures. Mr. Gray outlined the organization of the work and the numerous problems that have arisen on the project. After his talk, Mr. Gray showed many slides depicting the various phases of construction and types of equipment used.

J. C. Moore moved a vote of thanks to the speaker on behalf of all present for his speech on a topic so vital to Southern Alberta.

Moncton Branch

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

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

Supper Meeting—March 17

The Spray Power Development in Alberta was the subject of a talk given the Moncton Branch of the Engineering Institute of Canada by G. V. Eckenfelder, m.e.i.c., at a supper meeting, March 17 in the Moncton Curling Association Building.

A graduate of the University of Alberta, Mr. Eckenfelder is construction engineer for the Montreal Engineering Company, Ltd., and was resident engineer in charge of the Spray Development.

Mr. Eckenfelder was introduced to the gathering by W. D. G. Stratton, vice-chairman of the branch, who presided at the meeting.

The scheme of development, Mr. Eckenfelder stated, was to divert the water of the Spray River from its natural course at Spray Canyon and lead it, while maintaining its elevation, to a point above the Bow River where the vertical drop could be concentrated in a short horizontal distance. Water dropping through that height could produce large quantities of electric power.

This, he said, was done by damming the Spray Canyon, diverting the water through Spray Lakes Valley into Goat Creek Valley which runs parallel to the Bow River Valley, and finally bringing it out over Whiteman's Pass to rejoin the Bow River at Canmore.

Mr. Eckenfelder explained that before any actual work on the project could be done, a system of access roads had to be built. This was started in September, 1948, and first construction equipment reached the main damsite in December of the same year.

Near the South end of the project, the speaker stated, the main dam blocks the flow of the Spray River down the Spray Canyon.

Its earth-fill bulk rises 193 feet from the lowest level of bed rock to the crest. The dam is 640 feet long at the crest and 1,030 feet thick at the base. It contains 1,117,000 cubic yards of material—a task completed between May 20 and November 20, 1949.

Mr. Eckenfelder went on to explain that in order to contain the water in the reservoir created by the main dam, a second dam was constructed in Goat Valley behind the Three Sisters Mountain. This dam is 1,980 feet long and 48 feet high. Below the dam is located the Three Sisters power plant which contains a 3,600 horsepower propellor-type turbine unit with a 4,000 k.v.a generator. Its output will diminish as the level of the lake drops when storage water is used.

Water from the Three Sisters plant

is carried by a system of level canals and dykes down Goat Valley and through Whiteman's Pass to the intake of the pressure tunnel high on the slopes above Canmore. Mr. Eckenfelder explained many of the problems encountered in construction of the canals and dykes as a result of underlying layers of perma-frost and glacial silt.

The pressure tunnel, nearly 2,200 feet long, drops the water 905 feet from the crest of Whiteman's Pass to the Spray power plant. The top 1,236 feet of the tunnel is on a 45 degree slope with the lower 915 feet leading horizontally to the power plant. It has been finished to 7 feet 6 inches diameter by concreting at the upper end and steel lined over the lower end.

Nestled in a niche blasted in the hard rock wall at the base of Chinaman's Peak, which overlooks Canmore, the Spray plant is solidly placed to withstand the force of water dropping over 900 feet to its turbine. It is the main plant of the development and consists of a 62,000 horsepower turbine operating under a head of 905 feet. This is directly connected to a vertical generator of 47,500 k.w. capacity. In order to handle this large equipment a 145-ton crane is installed.

Water from the Spray plant, he continued, is carried by a canal to a point close to the Bow River west of Canmore when it takes its final plunge of 325 feet through a steel penstock to the Rundle plant, finally discharging into the Bow River. The Rundle plant operates under a head of 325 feet and with its 23,000 horsepower turbine turns a generator of 20,000 k.v.a. capacity.

All plants are completely automatic, the speaker said, and operated by remote control from a central control about 30 miles distant.

The three power plants of the development have a combined output of 88,600 horsepower. Each is picturesquely located in the rugged setting of the mountain country south of Canmore and Banff. Colour slides shown by Mr. Eckenfelder showed the beauty and strength of the development.

H. J. Williamson expressed the thanks and appreciation of the Moncton Branch to the speaker.

Montreal

R. B. Wotherspoon, M.E.I.C., *Secretary-Treasurer*

Joint Meeting With Military Engineers

Colonel J. R. B. Jones, D.S.O., chief engineer, Canadian Army, addressed a joint meeting of the Engineering Institute and the Military Engineers Association of Canada in the armoury of the 3rd Field Regiment, R.C.E., Hillside Ave., Montreal, on March 6th.

Colonel Jones was introduced to the gathering by Brigadier King Black and thanked by C. C. Lindsay, M.C., secretary of the Montreal Branch of the Military Engineers Association of Canada.

During his remarks Colonel Jones defined Military Engineering as "the art of directing the great sources of power in nature for the use and convenience of the military forces". The military engineer, continued Colonel Jones, "must be both a soldier and an engineer". Colonel Jones described the basic function of the Military Engineer as supporting the foreward troops by enabling them to keep mobile while at the same time denying mobility to the enemy. "In short", summed up Colonel Jones, "we must do all the engineering that enables the army to live, to move and to fight. Planning, training and organization are now going on so that we shall be ready when the time comes".

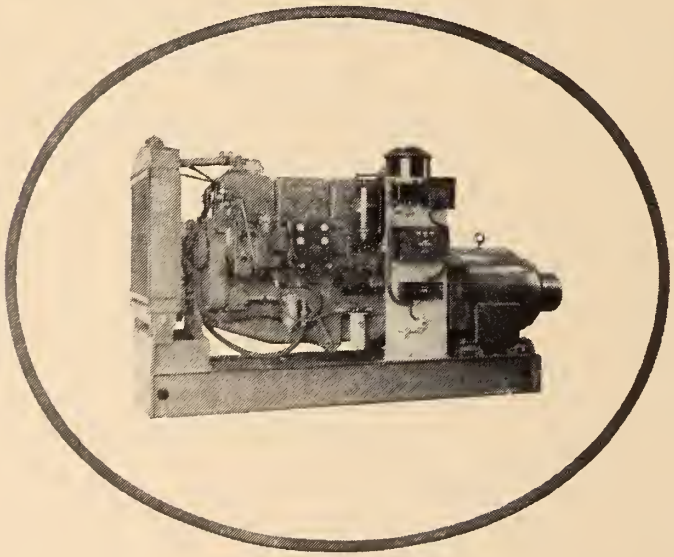
It was pointed out to the meeting that all engineer officers are selected from graduates in engineering and architecture. The chief engineer went on to discuss the training of engineers at the Royal Canadian School of Engineering at Chilliwack.

The value of the Northwest Highway system, or Alaska Highway, as a training ground for the Canadian Army was emphasized. Engineers and Sappers in particular have benefitted from the experience of maintaining and improving an equivalent of 1,500 miles of road since the system was taken over from the U.S. Corps of Engineering in March, 1946. Particularly valuable was the experience gained in the maintenance and construction of roads and bridges under Arctic conditions with temperatures sometimes as low as 83 degrees below zero.

The chief engineer also made a special appeal to members of the Engineering Institute and the Military Engineers Association to take an active interest in the military requirements for engineering and to give the R.C.E. the benefit of their highly specialized experience.

As Colonel Jones pointed out, Active

Cummins Diesels are preferred



throughout Canada because they are the "custom-built" diesel . . . proven in all fields to be the ultimate in dependability and economy of operation.

Cummins diesels are assembled into power units . . . generating sets . . . marine auxiliaries . . . pumping units . . . truck and shovel replacement engines . . . at Owen Sound, Ontario. There is a complete parts and service organization to make sure every Cummins diesel is kept in first-class operating condition.

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Shovels, cranes, industrial locomotives and switchers — Earthmovers, logging yarders and loaders — Off-highway trucks, crawler tractors — Work boats, pleasure craft — Buses and on-highway trucks

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UP TO 40% GREATER AMPERE HOUR OUTPUT

★ Figures based on battery installation of leading user of stationary battery power. Name supplied on request.

THE Exide MANCHEX BATTERY

In the installation mentioned above, several old-style 11-plate batteries were replaced by new 15-plate Exide Manchex batteries. Each old battery weighed 300 lbs. and delivered 400 ampere hours output.

By comparison, each new Manchex battery weighs only 200 lbs. yet delivers 560 ampere hours output . . . saving 33% in weight, with 40% greater power output.

Manchex battery elements are tightly packed into compact, moulded-glass jars. This allows a marked saving in space, a saving in weight, and an increase in power due to the fact that more plates can be carried in a given area.

Longer life, at full capacity, is obtained through the Manchester positive plate, with its unique lead button construction. Only a small portion of the total lead in the button is formed initially into active material. The remainder is available for gradual conversion in service. All other parts of the element are built to match the qualities of the positive plate. The result—increased power (watt) output per unit of space . . . less weight per ampere hour output *plus* longer service life and lower maintenance costs.

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EXIDE BATTERIES OF CANADA LIMITED
TORONTO

At the joint meeting of the Montreal Branch and the Military Engineers Association. Left to right: F. L. Lawton, E.I.C. chairman; Lt.-Col. J. F. Morazain, M.B.E., officer commanding the 3rd Field Regiment, R.C.E.; Col. J. R. B. Jones, D.S.O., chief engineer, Canadian Army, the speaker at the meeting; R. L. Dunsmore of the E.I.C.; Brigadier King Black, who introduced Col. Jones; and Guy Beaudet, of the Military Engineers Association.

Force engineers only form the nucleus of the engineering staff required on mobilization. "Our National Defence", concluded the Colonel, "relies chiefly upon the patriotic willingness of our citizens to partially prepare themselves during peace for voluntary duty during war".

After the joint meeting, officers of the 3rd Field Regiment acted as hosts to their guests at a buffet.

Electrical Section

R. J. Harvey, jr.e.i.c.,
Chairman

Mechanical Section

J. H. Ingham, m.e.i.c.,
Chairman

Visit to Montreal Locomotive Works Ltd., March 26

On Wednesday evening, March 26, Montreal Locomotive Works Ltd., played hosts to approximately 290 members of the Electrical and Mechanical Sections of the Montreal Branch of the Engineering Institute and the Montreal Section of the American Institute of Electrical Engineers.

Various work operations were demonstrated by a skeleton staff of skilled craftsmen and the well planned tour proved exceptionally interesting and impressive, to groups of visitors guided by M.L.W. personnel.

The primary work carried on at this plant is the construction of diesel-electric locomotives. These were seen in various stages of completion, from an "upside down" assembly of steel decks, to a gleaming streamlined 1,600-h.p., "A" unit, freight locomotive ready for the road.

A most heartening and gratifying aspect of the visit was the realization that the completed locomotives are truly Canadian products—resulting from Canadian enterprise using Canadian materials, labour and money. The generators, traction motors, control apparatus, etc., are produced by the Canadian General Electric Co. at their Peterborough plant. The diesel engines are built in Canada's only locomotive engine plant, Dominion Engineering Works, Lachine, P.Q. Montreal Locomotive Works, Ltd., build the locomotive frames, structures, etc., and carry out the assembly work.

At the time of the plant visit a number of interesting secondary construction projects were underway. Some of these were:- construction of steel mill equipment for Algoma Steel Corp., including fabrication of three 100' x 24' diameter hot stoves for a blast furnace; machining components for the new Fairless plant of U.S. Steel at Morrisburg, Pennsylvania (a special milling machine adapted by MLW for this work proved of great interest to many members): machining, assembling and testing heat exchangers for Alco Products Division.

On the completion of the tour, light refreshments were served in the cafeteria. A colour film, "Shining Rails", and a National Film Board short film on building diesel-electric locomotives at MLW were shown.

Mr. J. M. Sharpe, Chairman of the Montreal Section of the A.I.E.E., thanked Montreal Locomotive Works Ltd. for a very interesting and enjoyable evening, on behalf of the engineering organizations.

Mr. S. Wolf, chief engineer, Montreal Locomotive Works Ltd., outlines some work operations to members of the Montreal Branch, and the Montreal Section of A.I.E.E. during their recent plant visit.

Niagara Peninsula

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

V. S. Ellis, Jr.E.I.C.,
Branch News Editor

February and March Meetings

Near the end of February the members were addressed on **Plastics** by Mr. M. Wilkinson of C-I-L. March events included: speakers night for junior engineers; final meeting of the junior engineers' lecture series; and a plant tour of the Atlas Steels Ltd., Welland.

Mr. Wilkinson in his paper entitled **Plastics,** first gave the background of nylon by tracing its historical development and by outlining its present day applications. He then devoted the main portion of his talk to the manufacture and uses of a type of nylon known as moulding compound. This material, which results from the polymerization of nylon salts, has a tensile strength of 11,000 p.s.i., a shear strength of 10,000 p.s.i., a melting temperature of about 510 deg. F. and is insoluble in many chemicals. Its excellent abrasive qualities permit gears and sleeve bearings moulded from this nylon compound to out-wear metal parts. The nylon gears and bearings can be used best where the loads are light and the speeds are low. Mr. Wilkinson illustrated his address by showing the audience nylon bearings used in farm equipment, nylon mouldings used in medical apparatus, nylon worm gears and many other mechanical parts obtained from moulding this plastic. He stated that the machining properties of this material were similar to those of brass. The speaker predicted that in a year or so design data would be available for mechanical equipment moulded from nylon. Mr. P. Paquet proposed the vote of thanks which was heartily endorsed by the fifty members present.

The Junior Engineers' Speakers Night consisted of five fifteen-minute talks delivered by members of the Lecture Series. The three judges awarded first prize to Mr. S. Stuart for his paper entitled **The Master Key System.** The excellent criticisms of the speakers proved to be the highlight of this worthwhile meeting.

On March 18th the final meeting of the Lecture Series was held. It took the form of a Ladies' Night and the speaker was the well-known lecturer, Mr. Louis Blake Duff. His delightful address on the topic **Humours of the Press** was followed by refreshments. At this meeting the results of the elections for the executive of next year's Lecture Series were announced: Mr. G. Ince, chairman, Mr. C. Killoran, vice-chairman, Mr. H. Rynard, secretary-treasurer, Mr. G. MacDonald, Mr. D. Whitehead and Mr. F. Ness.

The March meeting of the Branch consisted of a plant visit of the Atlas Steels Ltd., Welland, followed by a dinner and a talk on **Stainless Steels.** Eighty-four members were welcomed by Mr. De Young, the works manager, and were conducted on an extensive and well organized tour of the plant. The after-dinner speech was given by Mr. E. W. Geary, vice-president in charge of sales. He emphasized that stainless steel had been developed to fight rust and mentioned that it has over 100,000 definite applications in the U.S.A. The speaker remarked on the need of sales promotion to inform the engineer of the uses of stainless steel and of the methods of handling and fabricating the material. Mr. Geary referred to the new $8,000,000 stainless steel strip mill now being built by the Atlas Company at Welland, Ont. The speaker illustrated his talk by a movie on Stainless Steel which described its development, its method of manufacture and its uses. Mr. Geary was accorded a sincere vote of thanks which was proposed by Mr. H. L. Weaver.

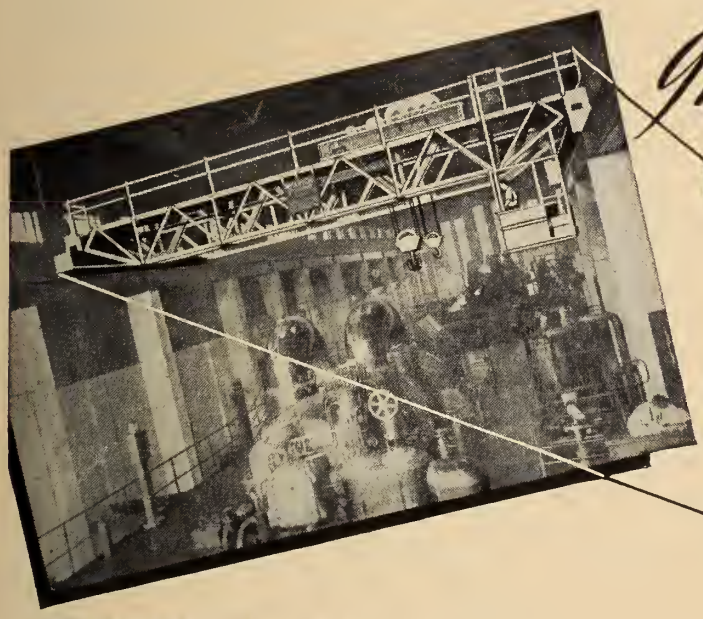
Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

S. T. Solinski, Jr.E.I.C.,
Branch News Editor

April Meeting

On April 15 Mr. R. L. Elliot of Northern Electric, the guest speaker at a smoker meeting, discussed **Quality Assurance in the Telephone Industry.**



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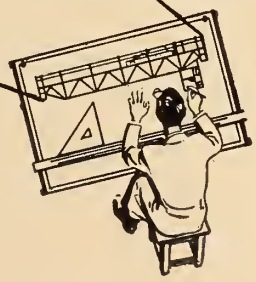

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The speaker introduced his subject by showing how the inspection and testing of incoming materials was employed to insure quality in the final product. He continued by explaining that a complete inspection of small manufactured items would make the cost prohibitive, and consequently random sampling is carried out on a scientific basis to determine if the lot will pass the required standards. This is done by taking a number of samples from the lot in which a certain number of rejects is allowed. If the number of off-standard items is within the accepted value, the lot is passed; however if this number exceeds the standard, a larger sample is inspected. The amount of rejects in this larger sample must fall in a certain range or the whole lot is then completely inspected.

Mr. Elliot outlined the methods used in Northern Electric plant quality control and told of the cooperation necessary between the inspection and production departments, concluding with a note on the benefits of proper interpretation of quality control. This is done on a monthly basis by graphs which give the percentages of various products which have passed the standards of inspection. This is significant in that experience has shown that if the quality falls below a certain level, the customer will run into excessive maintenance costs; and if above, the manufacturing cost of the item will be higher than normal.

From the number of questions which followed, the membership indicated considerable interest in this talk. The speaker was introduced by Chairman B. L. Davis, and thanked by Vice-Chairman D. F. Nasmith. The meeting closed with the serving of the usual refreshments.

Field Trip To Peribonko River Projects

On Saturday, August 18, 1951, over seventy members of the Saguenay Branch travelled by bus to visit two Hydro-Electric projects of the Aluminum Company of Canada on the Peribonka River.

These two developments, approximately equal in size, are designed to harness the power of the Peribonka at two sites, Chute du Diable, and Chute a la Savannes. The power will be used for the increased production of primary aluminum in the Saguenay district, which marks the first step in this Company's vast expansion programme.

An outstanding feature of the two projects is the problem of co-ordination and maintaining the two construction schedules, since the sites are only a few miles apart on the same river. A feature of the Diable project is the use of a moving cableway spanning the river. This cableway is used for all overhead handling throughout the construction. The interesting problems of construction include the building of coffer dams in the fast-running river, and the use of a concrete plug at Diable to divert the channel.

The party was guided throughout the tour by engineers of both Aluminum Company and the two construction firms, Pentagon at Savannes, and Fraser-Brace at Diable, and lunch was enjoyed in one of the camp dining rooms. Great interest in the tour was expressed, with the suggestion that it be repeated at a later date when construction would be more advanced.

Saint John

JOHN BRENAN, JT.E.I.C.,
Secretary-Treasurer

HARRY MCCLEAVE, M.E.I.C.,
Branch News Editor

April Meeting

On April 3 the Saint John Branch was addressed by Mr. R. E. Tweedale, development engineer for the N.B. Electric Power Commission, whose subject **Power Development on the Saint John River** proved to be of extreme interest to the 43 members present.

Mr. Tweedale pointed out that the Province's power requirements had been increasing at the rate of 10 per cent per year and that the present 275,000 hp. was not sufficient to encourage the establishment of new industries. However, he said that three sites chosen for development would provide more than double the total electrical power being developed at the present time.

Of the three sites, one, at Rankins Rapids in Maine would be an American project while the other two, at Morrill and Beachwood would be Canadian.

The Rankin Rapids site would, besides being a source of power, store water that would be lost otherwise. This would allow an increase in the existing Grand Falls plant due to the more even yearly flow.

The two sites in New Brunswick are between Grand Falls and Fredericton where the difference in elevation amounts to 300 feet.

The first site is at Morrill, about two miles above the towns of Perth and Andover and this dam with a drainage area of 8,300 square miles would supply 132,000 hp.

The second site is at Beechwood, a few miles north of the Town of Bath. This site has a drainage area of 13,300 square miles and has a potential of 176,000 hp.

In both of these areas some relocation of roads and railway lines would be necessary because of the flooding.

The large blocks of power made available from these developments would, it is felt, encourage industries to settle in New Brunswick, which would greatly bolster the Province's economy.

Mr. Tweedale's illustrated talk demonstrated the possibility for the development of large amounts of power on this river and the question and answer period that followed made obvious the keen interest of the members on this subject.

St. Maurice Valley

D. G. DEMIANIW, JT.E.I.C.,
Secretary-Treasurer

General Meeting, January

Mr. A. Lightbody, a research engineer with the Canadian Pacific Railway was the guest speaker at a general meeting held on January 14, 1952, at the Hotel Chateau de Blois at Trois Rivieres, Quebec. The speaker's subject was **Dieselization of Canadian Railways.**

The speaker was introduced by D. E. Covey, vice-chairman of the local branch and thanked by E. R. McMullen of the Consolidated Paper Corp.

In his address he traced the development of the diesel-electric locomotive on the North American continent; he also described the gradual replacement of the steam driven locomotive by the diesel-electric within his company. The first diesel-electric locomotive was purchased by the C.P.R. in 1943; the first division within the C.P.R. to be completely dieselized was Vancouver Island and in 1949 the rail line between Montreal and Wells River, Vermont, was dieselized by replacing 41 steam locomotives by 33 diesel units. Freight service is being more quickly dieselized than passenger service. During 1952 all services between Revelstoke, B.C., and Calgary, Alta., will also be completely dieselized.

One of the difficulties being encountered by the railways during this conversion period is the necessity for the provision of servicing and maintenance crews for both steam and diesel locomotives. Also many of the rail sidings are not large enough to accommodate the longer trains made possible by the diesel.

The advantages of the diesel-electric locomotive over the existing steam units are the use of dynamic braking, elimination of fireman helpers, increased line capacity, and lower fuel and maintenance costs. An interesting film in technicolor illustrated many of the points discussed by Mr. Lightbody.

Buffet Supper, February

On February 20th, the members of the branch participated in a buffet supper held at the Cascade Inn, Shawinigan Falls. The guest speaker for the occasion was Mr. C. J. Lentz of the Quebec Iron and Titanium Corp., Sorel, Quebec. Attendance at the supper was 38; at the meeting the attendance rose to 60—an indication of the current interest in the speaker's subject **Manufacture and Uses of Titanium and Titanium Dioxide.**

Mr. Lentz was introduced by Mr. J. S. Whyte of Shawinigan Chemicals Ltd. In his address, the speaker gave the reasons for the building of the smelter at Sorel, Quebec, for the production of titanium dioxide and iron from ilmenite ore. India had for a long time been the world supplier of ilmenite ore which contains approximately seventy per cent titanium dioxide and twenty-five per cent iron oxide. After the recent war the Indian government restricted the exportation of the ore in order to build up her own pigment industry. The discovery of large bodies of ilmenite in Quebec province coupled with its cheap power led to the formation of the Quebec Iron and Titanium Corp. under the joint ownership of the Kennecott Copper Corp. and the New Jersey Zinc Co. of the United States. The Canadian ilmenite is not as rich in titanium as the Indian or Australian ores.

Mr. Lentz gave a very detailed description of the materials handling system for the ilmenite ore which is transported from Seven Islands, Quebec, to the smelter site at Sorel. The first electric smelting furnace for the separation of the crude titanium dioxide and pig iron was brought into operation during September, 1950. The extreme reactivity of the titanium dioxide imposed many difficulties on the furnace operation. Both titanium dioxide and iron are tapped intermittently from two different levels in the furnace. The titanium dioxide, after disintegration, is shipped to the United States for further treatment into refined material which will be suitable for pigment manufacture while the iron is further treated in a separate electric furnace for the removal of sulphur and is then sold to steel fabricators in Canada.

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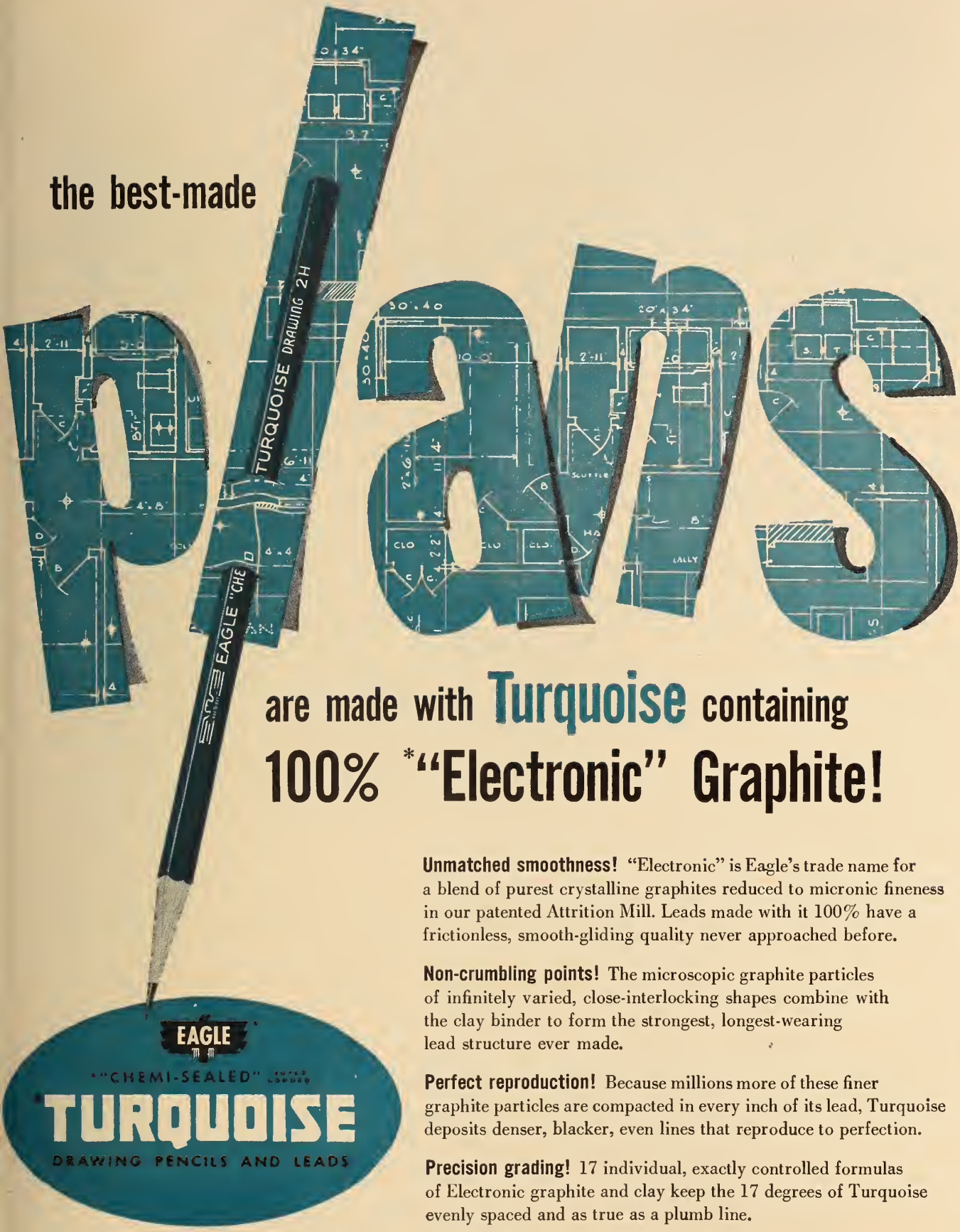

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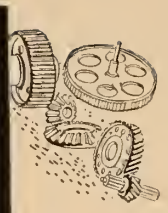

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Although titanium metal is extremely resistant to many corrosive media and possesses a high strength and low density, the extreme reactivity of the metal in the molten state to such gases as nitrogen and oxygen has prevented the rapid development of a cheap method for the reduction of the titanium dioxide to the metal. The speaker gave an excellent review of the methods which had been suggested or tried for the production of the metal. Current metal production is small.

The speaker was thanked by Mr. N. R. Fasken of the Research Dept. of the Shawinigan Water & Power Co.

Shawinigan Falls Junior Section

General Meeting, February

Dr. Morris Katz of the National Research Council was the speaker at a general meeting held on February 28th at the Cascade Inn, Shawinigan Falls. The speaker who is chairman of the Canadian Section, Technical Advisory Board on Air Pollution, International Joint Section, presented an interesting and informative talk on the problem of atmospheric pollution and the work his committee is doing. His talk was illustrated by slides. An active question period followed his address. Mr. J. F. Whitehead of C-I-L introduced the speaker while Mr. M. A. Murphy of Shawinigan Chemicals Ltd. thanked him. Prior to the meeting, the speaker was taken on a tour of the local Cellophane plant of C-I-L and the Carbide Plant of Shawinigan Chemicals Ltd.

Trois Rivieres Junior Section

January Meeting

Mr. John F. Wickenden, the director of the John F. Wickenden Company presented a talk on the **Engineer and Business** at a meeting on January 30. He outlined the important considerations for a young engineer entering into business for himself. These included the securing of capital, the important place of selling, self-analysis, partnership, perseverance and accounting methods in such a scheme. He also suggested that junior engineers would be well advised to adopt a definite investment programme early in their careers.

February Meeting

A meeting on February 13 took the form of a panel discussion. Three subjects were discussed: (1) Separation of the St. Maurice Valley Branch into two separate branches, (2) The Advisability of Construction of the St. Lawrence Seaway by Canada without U.S.A. Participation, and (3) Whether or not We Should Encourage the Entry of European Engineers into Canada.

The majority of the members present were in favour of separating our branch into two separate branches, one at Trois Rivieres and the other at Shawinigan Falls. Most were also in favour of the immigration of European Engineers into Canada, but felt that the present shortage of engineers could be greatly relieved by more efficient utilization of men already in industry. There was also general approval of Canada's intention to tackle the St. Lawrence Seaway problem alone.

Many juniors at the meeting pointed out that there was no probability of U.S. participation in the seaway project because of the determined opposition of several pressure groups in the U.S. congress. Regarding the immigration of European Engineers some persons were concerned with the problem of properly evaluating the technical qualifications of these engineers in order that the standards of the profession would be maintained. Almost all section members thought that such engineering talent was at present wastefully employed in positions which could be filled just as well by competent technicians.

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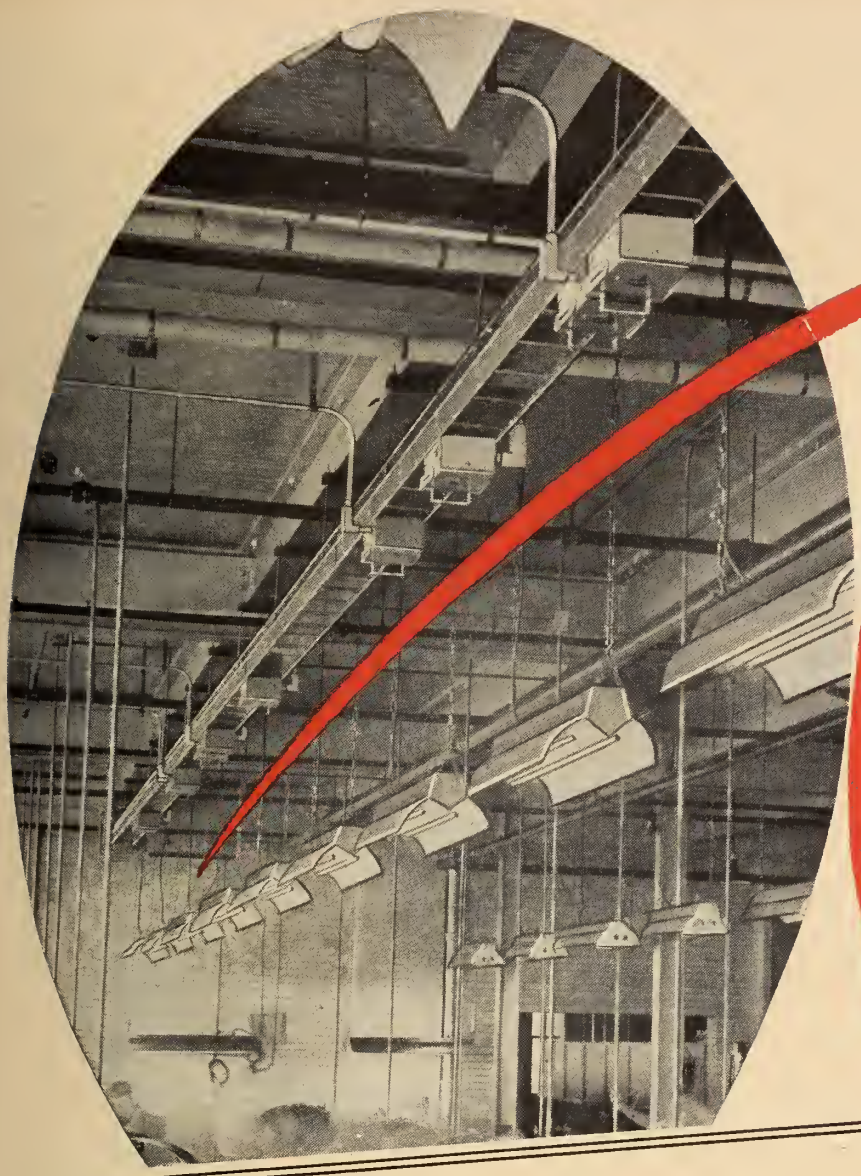

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Sudbury

W. S. Black, M.E.I.C.,
Secretary-Treasurer

A. D. Finlayson, Jr.E.I.C.,
Branch News Editor

Dinner Meeting

The monthly dinner meeting of the Sudbury Branch of the Institute held on March 4, 1952, was addressed by Mr. D. W. Walkington, special assistant to the sales manager of the Chemicals Department, Canadian Industries Ltd.

Dr. R. W. Allgood, works manager of the Copper Cliff Acid Plant of the C-I-L introduced the speaker. He stated that Mr. Walkington, in his position in the sales department, has gained a wide knowledge of the uses of chemistry and was well qualified to speak on his subject **This Chemical Age.**

Mr. Walkington first emphasized how quickly chemistry has been moving in the past few years. Only twelve years ago the first of the "wonder drugs" was introduced. Now there are many in common use. At that time nylon was only a year old. Since then four more textile fibres have been developed. Modern weed-killing chemicals were not in use.

A recent chemical development has been the production of D.D.T. Though it has been very successful in combatting insect pests there are indications that some are already becoming immune to it. New chemicals are being developed to take its place. The new "bomb" container for dispensing D.D.T. is also a product of modern chemistry. This container is succeeding the use of the spray gun in a variety of applications.

To aid the cook, chemistry has produced mono sodium glutamate which, sprinkled on food before it is cooked, accentuates the natural taste.

In the past 15 years the effect of colours on the efficiency of people in their daily work has been studied and has resulted in an increase in the use of paint to brighten schools and places of work. A new development is a paint which will carry an electric current. This is especially useful in hearing aids where a minimum of size is desirable. The electrical circuit can be painted on a piece of insulation.

Though synthetic rubber is not well remembered for the tires produced of it during the last war, in many cases of its use today it is better than natural rubber. Where rubber is in contact with gasoline, grease or perspiration, synthetic rubber far outlasts natural rubber. For satisfactory results the proper synthetic rubber must be used in the proper place.

Plastics are an important development but were misused when first introduced. Manufacturers are now being instructed in the proper use of the many different types.

Mr. Walkington referred to the development of textile fibres as one of the most important of recent chemical advances. The many new types of fibres make it possible to engineer fabrics by blending the fibres. Nylon is now well known for its strength. Orlon resists sunlight and chemicals and is very silk-like in appearance. Dacron looks much like wool and is not elastic. Men's suits are now being made which can be cleaned by wearing into a shower and washing with soap and water.

Mr. Walkington had many articles on display to illustrate the uses of new chemicals.

Mr. F. J. deStefano thanked the speaker for his very interesting address.

Winnipeg

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

President's Visit

Ira P. Macnab, the president of the Institute, visited Winnipeg Branch over the weekend of April 13th, 1952.

On Tuesday, following a dinner at which the Management Committee of the Branch entertained the president, a general meeting was held in Theatre "B" of the Government Offices, Winnipeg.

C. L. Fisher, the chairman of the Branch, introduced Dr. Macnab, and in doing so gave a short sketch of his career as a practising engineer.

The president spoke more particularly about his official visitations and how these had given him an entirely new conception of the geography of Canada, of its vastness, and of the industrial development of our country and the magnitude of some of the projects already completed and of those underway. He mentioned that it had been his privilege to institute several new branches, and spoke of others in the process of being established.

The Engineers Wives Association entertained Mrs. Macnab. On Monday, April 15th, its executive had a luncheon gathering for her at the Manitoba Club and afterwards took her on a tour of Winnipeg. On Tuesday afternoon Mrs. W. D. Hurst gave a Coffee Party in her honour, at which there were 125 guests present.

Electrical Section

J. G. Dickinson, M.E.I.C.,
News Editor

April 3 Meeting

The Electrical Section of the Winnipeg Branch, was favoured with an excellent paper entitled **Air Blast Circuit Breakers.** Mr. R. A. Moore, at the meeting held April 3rd, in room 323 New United College Building. Mr. Moore is assistant chief engineer of the English Electric Company of Canada Limited, St. Catharines, Ontario, and is somewhat of a pioneer in the design and manufacture of air blast circuit breakers on this continent.

The paper began with a brief review of air blast circuit breaker fundamentals, referring particularly to voltages over 15 kv. Three basic types of air blast were given as forming the background of all air blast breakers—cross blast and axial blast are the most common ones used.

By means of slides Mr. Moore illustrated these types. The method of using shunt resistors to slow up the rate of rise of restrike voltage was also illustrated and the practical reasons shown why this method was omitted in most breakers over 33 kv. It was interesting to note the means used by Mr. Moore's company to reduce moisture content in the blast air. This was done by compressing the air initially to a valve over the normal air blast pressure and thereby squeezing out moisture in the process. This seemed to reduce the moisture level sufficiently because, to his knowledge, there had not been any complaint of frozen valves. An illustration of a compact ready to install compressor with all auxiliaries was shown which can now be purchased with the breaker.

Mr. Moore then went on to higher voltage class breakers, illustrating them with slides. The multiple breaker head unit type with two and three breakers per pole came in the class. Disconnects are a part of these units because the breaker is only insulated for line voltage under compressed air conditions which, of course, exist only at breaking. The disconnect is designed to make on fault currents.

The talk was followed by an interesting film entitled "The Fontenay Tests". These tests were made on the French Electrical System at a test station at Fontenay, near Paris. They were conducted on some English Electric 150-kv., 2,500-mva. (symmetrical) air blast circuit breakers manufactured in England for the British Grid. Tests were conducted using the 354-kilometer transmission line to demonstrate the equipment's ability to break the unloaded charged line. The tests were at 180-kv. single phase to ground. Other tests demonstrated the ability of the gear to successfully break its rated interrupting capacity.

A question period followed the paper. Mr. Cliff Haltation of the Winnipeg Electric Company very effectively thanked the speaker.

Vancouver

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

W. L. Inglis, M.E.I.C.,
Branch News Editor

Dinner Meeting April

On April 16 the New Westminster members of the Vancouver Branch were hosts at a dinner meeting held in the Hollywood Bowl and Grill in New Westminster, attended by more than fifty members and guests.

The principal speaker was Mr. Thomas Morgan, manager of the Westminster Shook Mills Ltd. who spoke on **Utilization of Sawmill Wood Wastes.** Tracing the development of the operation of his own mill, he pointed out the changes that have taken place in recent years in the utilization of low grade lumber and waste materials that were formerly disposed of in their burners. He stated that the present trend is toward integrated operations wherein waste is practically eliminated.

Referring to a tour which he had made of the Weyerhauser Timber Company's plants in the United States, he dealt at some length with developments in integration by this Company which produces lumber, plywood, pulp and paper, bark products, presto-logs, etc. The Weyerhauser Company, he said, employed a large group of engineers and scientists engaged in research and development which has resulted in improved methods of production as well as a number of new timber products.

Mr. Morgan explained that it is the aim of the timber industry to attain complete utilization of all raw material from the woods. In addition it hoped to assure continuation of plant operation indefinitely through improved logging procedures and reseeding of logged areas.

Following the speaker, an interesting color film was shown by Mr. Al Hardy of the Atlas Steel Company covering the manufacture of tool steels in his company's plant at Welland.

Thanks of the evening were expressed by the chairman S. H. de Jong, Bill Scott and Dick Walker.

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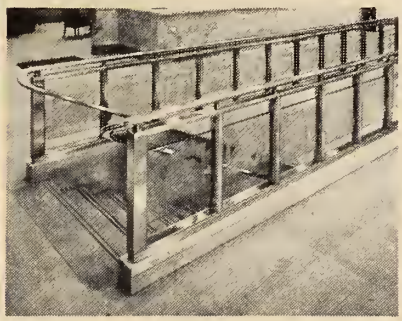
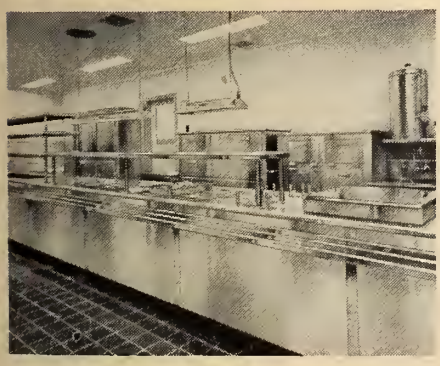
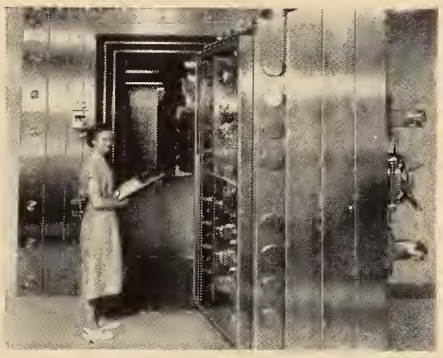


Stainless Steel Decorative Trim used extensively throughout the 25-storey building, is fabricated almost entirely from steel supplied by Atlas. No other metal surpasses stainless steel for functional adornment in architecture. Its gleaming lustre is impervious to weather and wear. It resists tarnishing and corrosion, requires little or no polishing. Shown above and right are the stainless-trimmed stairs leading out of the main banking room, an elevator lobby, and a portion of the main entrance doors. Stainless steel was used also for window trim, cheque desks, balustrades, door frames, and a beautiful window panel containing more than a ton of stainless. Approximately 100 tons of stainless steel, supplied by Atlas, went into the building.



Stainless Steel in the Cafeteria. For cleanliness, long life, ease of maintenance and inviting appearance, stainless steel was also chosen for the Bank's cafeteria fittings and equipment. Stainless is the number one choice in metals for use in cafeterias and restaurants everywhere.



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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

The Engineers' Illustrated Thesaurus. Herbert Herkimer. New York, Chemical Publishing Company, 1952. 572 pp., illus., $7.20.

Although many reviews have been written of this book since its publication early in 1952, we have not yet seen its rather unique value adequately stressed, certainly as far as our recent experience is concerned.

The idea for this Thesaurus came originally from a suggestion to young engineers to compile a personal pocket data book. Not content with this, Mr. Herkimer went into more detail on the project, and started work on a scrap book of engineering drawings, sketches, diagrams and abstracts from patent publications and trade catalogues.

The result is over eight thousand illustrations of mechanical movements, machine parts, and details, said to be the largest collection ever assembled, presented with the barest minimum of text.

The value of this to practically every type of engineer need scarcely be stressed. It is a must for all technical library bookshelves, and many many private ones.

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

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Advanced Five-Figure Mathematical Tables. C. Atwood. Toronto, Macmillan, 1951. 69 pp., 90 cents.

This work has been planned as a continuation of the tables published under the title "Practical five-figure mathematical tables". It includes tables of trigonometrical functions of angles expressed both in radians and in decimals of a degree, exponential and hyperbolic functions, complete elliptic integrals, the factorial function and tables relating to the normal probability curve. The interval of tabulation has been so selected that the simplest of all methods of interpolation, namely the method of mean proportional parts, suffices for most of the tables whilst alternative aids have been provided when this method fails. The author has followed modern trends in conventions and symbolism whenever these appeared to have practical advantages.

After the Whistle Blows: a guide to the field of recreation in industry. Jack Petrill. New York, Industrial Recreations Bureau, 1949, 351 pp., $12.00.

Speaking of factory and plant workers, the author asks: "what is it they want after the whistle blows? They want friendliness, understanding, a chance and the facilities to relax and do the things they want to, and a time to forget the complexities of the day's work." This is a volume of suggestions as to how this may be achieved.

Starting with the founding of the Industrial Mutual Association at the turn of the century, it carries through with an explanation of the organization of the recreation project, the preparation of the programme, and a very large variety of suggested activities, comprising one hundred and seven pages.

A one hundred and thirty pages appendix is concerned with actual organizations, their constitutions, annual reports, financial statements, daily bulletins and programmes, and statistics of interest in the various sports and activities.

A very practical bibliography, and an alphabetical index further enhance the value of this volume.

Building Research Congress 1951. 3 volumes. London, Building Research Congress, 1951. illus., 50/-.

Each of these three volumes contains papers presented in one of the three divisions of the 1951 Building research congress. The first volume consists of twenty-four papers on the influence of mechanisation and prefabrication on techniques and cost of building, on the influence of modern research on structural design and on the influence of modern soil studies on the design and construction of foundations. The second volume contains twenty-three articles dealing with research on weathering and durability, burnt clay products, cement and concrete, building stones and lime, paints and plaster, timber technology. The forty-one short articles of the third volume cover the acoustics of auditoria and studios, the heating and ventilating of buildings in relation to summer and winter conditions, the lighting of buildings, and the problems of three specific types of buildings. Bibliographical references are given after each paper.

Canadian Railway Guide with Airlines. Montreal, International Railway Publishing Co., 1952. Maps, $4.00.

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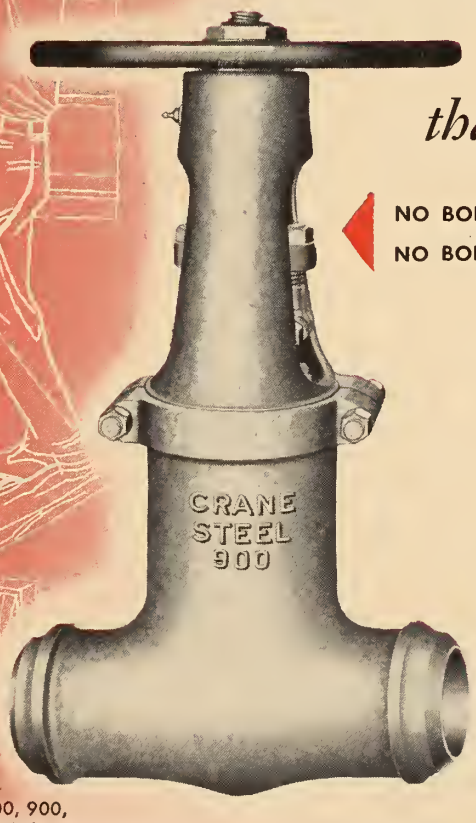

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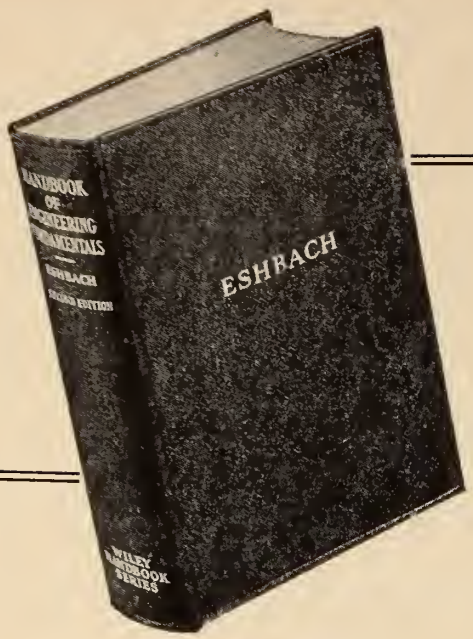

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Cathodic Protection: Report of Correlating Committee on Cathodic Protection, July 1951. Houston, Texas, National Association of Corrosion Engineers, c1951. 33 pp., 50 cents.

This report is a consolidation of four papers on cathodic protection from corrosion. The first paper gives management information on cathodic protection, while the second deals with notification procedures and the third deals with technical practices. The fourth paper covers joint cathodic protection systems. Useful lists are given in the form of appendices: joint electrolysis committees, publishers of maps and directories, record of joint cathodic installation, etc. A selected bibliography is included.

Design and Placing of High Quality Concrete. D. A. Stewart. London, Spon, c1951. 112 pp., illus., 25 –.

The author states the purpose of this book to be the bringing about of a "greater appreciation of a fine engineering material which, both in the past and in the present, has suffered and is still suffering from a lack of understanding of its characteristics and qualities."

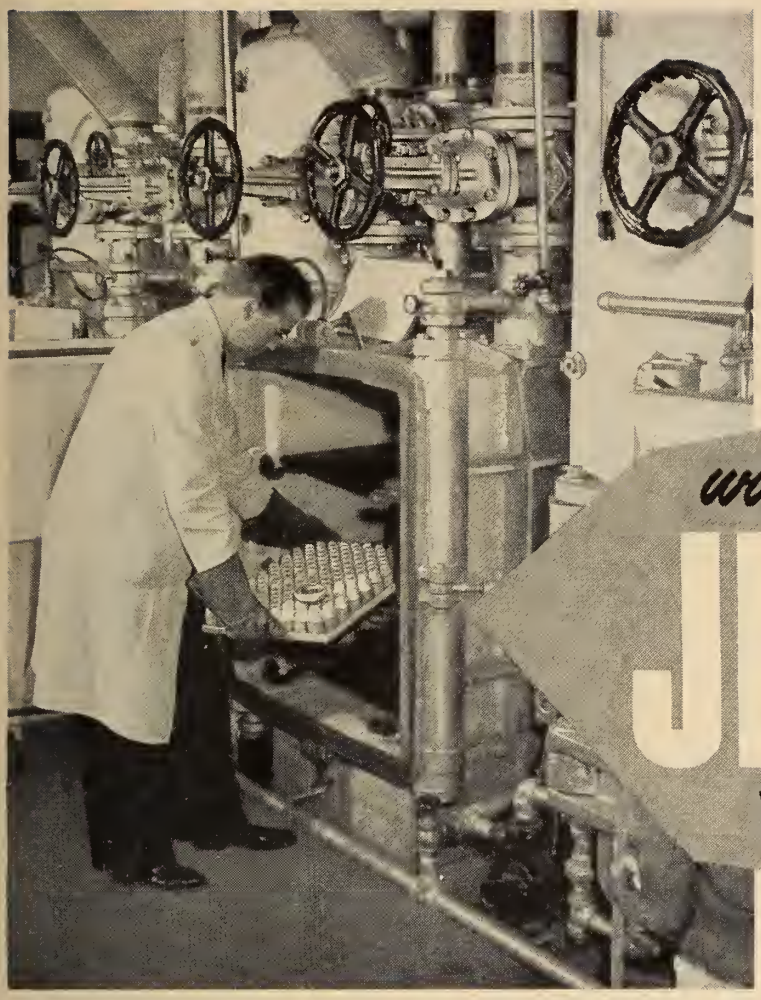
The economy and increased strength of the finished product resulting from the designing of each mix for the purpose in hand is the main theme of the volume. It will be both useful, and informative, to all our members interested in concrete technology.

Displacement Pumps and Motors. R. Hadekel. London, Pitman, c1951. 171 pp., illus., $5.00.

This work is addressed to engineers concerned with the design and development of machines such as transfer and high pressure pumps, hydraulic or compressed air motors, engine accessories such as oil or fuel pumps and blowers, etc. This is a book of a general nature and its treatment of some questions is sketchy. Its purpose is to establish fundamentals, there being a lack of literature on machines of this kind. The following types of machines are covered in individual chapters: piston machines, gear machines, van machines, machines based on spherical and skew mechanisms, variable capacity machines, hand pumps and foot pumps. These machines and their operations are well illustrated. The book contains an index but no bibliographical references.

Earth's Magnetism. 2nd ed. Sydney Chapman. London, Methuen, Toronto, British Book Service, c1951. 127 pp., illus., $1.25.

This monograph contains a brief but fairly broad account of our present knowledge of the earth's magnetic field and its changes. The mathematical developments of the subject are barely indicated while the space available has not allowed more than passing reference to such cognate



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Exercices de Radio-Electricité: Lignes, Antennes, Hyperfréquences. S. Albagli. Paris, Gauthier-Villars, 1952. 76 pp., illus., 550 fr.

This is a compilation of twenty problems in radio-electricity with their solutions. These problems deal with lines, antennas and high frequencies. They are intended to be understood without too much difficulty by student engineers and technicians having a working knowledge of the basic formulas of radio. Such an assembly of practical exercises and numerical applications will further the student's understanding and assimilation of lectures on radio-electricity.

Introduction to the Theory of Control in Mechanical Engineering. R. H. Macmillan. Cambridge, University Press, Toronto, Macmillan, 1951. 195 pp., illus., $5.75.

Until recently, information on this subject has been limited, in Great Britain, to articles and papers read before various institutions. This book has been written as an attempt to fill this gap. It is an introductory account and intended to be perfectly intelligible to any engineer or physicist and not only to the specialist. The early chapters, which are mainly descriptive, explain the principles which underlie the operation of all control systems; sufficient elementary mathematics is then introduced to estimate the performance of any simple system. In the last three chapters, rather more advanced techniques are used to give an account of the methods universally employed by control engineers to-day. This work contains many diagrams, an index and a bibliography.

Muddy Waters: The Army Engineers and the Nation's Rivers. Arthur Maass. Cambridge, Harvard University Press; Toronto, Saunders, 1951. 306 pp., illus., $6.25.

A glance at the title or sub-title of this book could leave one with a very erroneous idea of its contents. Muddy Waters refers more to muddy political waters, than it does to rivers which have been, or should be, dammed.

The author may have a very good case against the army engineers, but unfortunately he writes as one having an axe to grind, making his language, at times careless and ill-chosen.

However, the information as set forth in this volume, along with the statistics, are both informative, and revealing, and will prove absorbing and interesting to all our readers concerned with this particular aspect of engineering and the American government.

Notes on Industrial Engineering. Joseph Krol. Winnipeg, University of Manitoba. 170 pp. Mimeographed pages.

A great many aspects of industrial engineering are covered by this course: Trends of modern industry; fundamentals of scientific management; product selection methods; equipment planning; plant layout and location; purchasing, receiving, handling and storing of materials; production, quality and cost control; coordination, etc. A few references to other books are given at the end of each chapter and four sets of question are given at the end of the book. Included are a great many tables, diagrams and formulae, giving to this work a very systematic aspect. There is no index.

Who's Who in Australia, 14th ed., 1950: an Australian Biographical Dictionary of Titled Persons, with which is incorporated "John's Notable Australians". J. A. Alexander, comp. and ed. Melbourne, Colorgravure Publications, 1950. 816 pp., 52/–.

As we said of the recently published Canadian Who's Who, no one can pay for inclusion in this volume.

Containing over seven thousand biographies, including one thousand five hundred and forty new names, Who's Who in Australia contains a wealth of official, heraldic, and miscellaneous information, in addition to the usual list of abbreviations, obituaries, government officials, etc. The most notable of these are the Australian Guide to Titles, the Baronetage in Australia, the Knightage in Australia, the Commonwealth Table of Precedence, Mode of Addressing People of rank and official positions, and Wearing of orders and decorations in uniform — evening dress, morning dress, and every day dress. As these rules and practices apply throughout the whole British Commonwealth, and as this is the most complete and up-to-date Australian biographical information currently available, it will prove a valuable addition to many libraries.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Eléments d'optique électronique. Gaston Dupouy. Paris, Armand Colin, 1952. 218 pp., illus., 260 frs.

Following an introductory chapter the author discusses the refraction and reflection of electrons in an electric field. Subsequent chapters cover in detail the construction, characteristics, and performance of both electrostatic and magnetic electronic lenses. Aberration and other problems are discussed, and the analogies and differences between glass lenses and electronic lenses are indicated. The final chapter takes up the electronic microscope and its use.

Finite Deformation of an Elastic Solid. F. D. Murnaghan. New York, Wiley, 1951. 140 pp., $4.80.

The essential feature of this book is the consideration of squares and higher powers of the strain components in the theory of elasticity. This treatment permits the application of the theory to larger deformations and stresses than those allowed by the classical theory. Matrices are used methodically with a preliminary explanation in the first chapter. Topics of special interest are the importance of non-isotropic media and the problem of deformation under extreme pressures.

Plane Table Mapping. W. Low. New York, Harper, 1952. 365 pp., illus., $5.50.

A manual for geologists, civil engineers, and foresters, as well as a college text, which describes in detail the plane table methods by which a field survey is carried out from its inception to the finished map. Space is devoted to the care and adjustment of surveying instruments, characteristics of aerial photographs, drawing instruments and the finished drafting of maps, and various useful data tables.

Plastics Molding. John Delmonte. New York, Wiley, 1952. 493 pp., illus., $10.80.

A detailed treatment of the equipment and methods for the various types of molding processes by which plastic products are formed. Approached from an engineering viewpoint the book considers the flow of materials and the techniques for handling the materials once the flow has been established. This involves not only the molding itself but also the subjects of heat and pressure generation, distribution, and application, instrumentation and control, and plant layout. Specific problems are noted and discussed in connection with each process.

Soil Engineering. G. Spangler. Scranton, International Textbook Company, (Laurel), 1951. 458 pp., illus., $8.00.

Written for the beginner in the field, this book should be useful to undergraduate students and to practicing engineers who have not had formal training in soils. Some of the chapters are on the nature of soil, structure and texture, density, water in soils, engineering soil classification, frost action, thickness of flexible pavements, stress distribution, stability of slopes, embankments, levees, earth dams, pressure on retaining walls, piles, and underground conduits.

Tacheometry. F. A. Redmond. London, Technical Press, 1951. 348 pp., illus., 21s.

This book is a general treatise on the use of optical methods and instruments for measuring distances in surveying. Special attention has been given to that branch known as stadia measurement. Written for students and surveyors, the practical side of the subject has been stressed, including a special chapter on field work.

STANDARDS

British Standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W.1. British Standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 37: 1952, Parts 1 and 2 — Electricity Meters. 4/–.

Part one contains the general clauses applicable to all types of motor meters while part two deals with single-phase two-wire whole-current credit type meters. The first part covers reference standards and definitions, and such matter as general construction, terminals diagram of construction, temperature-rise, insulation, etc. Standard ratings, dimensions, speed of rotation, power losses, limits of error, etc. are found in the second part.

B.S. 499: 1952, Section 7 — Scheme of Symbols for Welding. 6/–.

This standard departs from previous practice in two fundamental respects. The terms "near side" and "far side" have been discontinued in favour of the terms "arrow side" and "other side". This not only provides uniformity with the American scheme, but overcomes the difficulty

encountered in some views of welds where the former terms were inapplicable. It has also been decided that the disposition of the weld symbol relative to the reference line should be based on the American system.

B.S. 1270: 1952 — Schedule for Electric Discharge Lamps for General Purposes. 2/–.

This present edition of the schedule is confined to tables of dimensions, nominal efficiencies and life. An appendix is included giving the location of dimensions of MCF/U fluorescent lamps listed in the schedules. In an effort to keep size within limits, a system of coding has been adopted.

B.S. 1760: 1951 — Carbon Steel Castings for Surface Hardening. 2/–.

Carbon steel castings for surface hardening by a local heating and quenching process are covered. Two grades are specified: Grade A is required to show a tensile strength of 40 ton/sq. in. and a surface hardness after hardening of 550 DPN. Grade B is required to show a tensile strength of 45 ton/sq. in. and a surface hardness after hardening of 600 DPN. Chemical composition is specified and inspection and testing are covered.

B.S. 1782: 1951 — Couplings for Suction and Delivery Hose other than Fire Hose (1½ in. to 8 in. nominal sizes). 5/–.

Two types of couplings are specified in this standard: the screw type and the swivelling-ring swing-bolt type. The design of the couplings differs from those previously used in having ribbed instead of serrated tail ends. The screw type couplings have a thread of coarser pitch, while the more robust thread and more substantial horns lead to easier coupling and confer ability to withstand rough usage. For any particular nominal size of coupling two diameters of tail end are provided: full bore and reduced bore.

B.S. 1790: 1952 — Length Bars and Accessories. 3/–.

This is one of a series on engineers' precision tools. It relates to length gauges of the cylindrical bar type in both inch and metric units, standards of accuracy being specified for reference, inspection and work-shop grades. The essential features of design and accuracy are specified for the two types of accessories commonly used with work-shop bars, namely: those with collet attachments and those for use with screws and studs. Recommended sets of workshop bars are given in an appendix.

B.S. 1821: 1952 — Oxy-acetylene Welding of High Temperature and High Pressure Pipelines. 6/–.

This standard is divided in four parts: Part one defines the parent metals and specifies the types of filler rods, welding technique, general precautions and qualifying tests for welders. Part two deals with butt joints and specifies the method of preparation and the requirements for the completed welds. Part three, for branches, includes details of preparations for the set-on and set-in types. Sleeve welds are covered in Part four.

B.S. 1822: 1952 — Nickel Clad Steel Plate. 2/–.

This standard specifies steel plate to which a layer of nickel is integrally and continuously bonded on one or both sides. The base steel is required to comply with B.S. 1501-151, -154, or -157. A high purity nickel is specified and tests are included to ensure efficient bonding between the nickel and the steel.

B.S. 1824: 1952 — Nickel Silver Strip and Foil for the Telecommunication Industries. 2/–.

The standard lays down chemical compositions, temper grades, mechanical properties and tolerances on dimensions and specifies the procedure to be adopted in selecting test pieces and carrying out tests. Details are also given in regard to test certificates and independent tests while an appendix contains a summary of the information to be given by the purchaser in enquiries and/or order.

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B.S. 1825: 1952 — Determination of Cadmium in Copper-Cadmium Alloys (Electrolytic Method). 1/6.

This is a method of determining the cadmium content of straight copper-phosphorus-cadmium alloys, as used in the manufacture of trolley and contact wire for electric traction. The method is suitable for cadmium contents up to 2% and specifies reagents, recommended methods of sampling and the test procedure.

B.S. 1840: 1952 — Tubular Steel Columns for Street Lighting. 3/-.

The specification gives the standard heights of the light source, namely, 30 ft, 25 ft, 15 ft and 13 ft. It specifies details of construction and the loading for which the columns are to be designed. An appendix gives the design of and notes on a series of typical columns.

B.S. 1161: 1951, Addendum No. 1, P.D. 1331 — Aluminium and Aluminium Alloy Sections. Free.

These notes recommend that an alloy chosen, not only for its mechanical and structural strength but also for its ease of forming and its durability. Notes on the working and heat treatment of the various alloys and tables of torsion constants for the sections specified in B.S. 1161 are included.

B.S. M. 23: 1951 — Identification Scheme for Aircraft Pipelines. 2/-.

Identification is provided by the combination of a written description of the main function of a line with one of a series of geometric symbols suitable for international use. The scheme is independent of the use of colour.

Canadian Standards, Canadian Standards Association, National Research Building, Ottawa.

CSA B89.3: 1952 — Automobile Fire Fighting Apparatus. $1.25.

The specification suggests for each type of apparatus a size of tank and pump, and the amount of hose and accessory equipment. There are also a few pages of information for municipal officials and four specification forms entitled: "Conditions of tender and acceptance for automobile fire apparatus"; "Special provisions for pumper (triple combination)"; "Special provisions for ladder truck (aerial)"; "Special provisions for ladder truck and pumper (quadruple combination)".

CSA B89.4: 1952 — Trailer Type Fire Pumping Units. $1.00.

This specification covers the performance aspects of the unit, such as carrying capacity, pumping capacity, effects of altitude. The engine is dealt with in details: cooling system, lubricating system, carburetor, ignition, starter and batteries. Paragraphs are also devoted to throttle, brakes, axle and wheel, tires, springs, towing device, fuel supply, body construction and finish. Also included is a form of acceptance of the unit by a municipality.

CSA C22.2 No. 60: 1951 —Construction and Test of Arc-Welding Equipment Transformer Type. $1.00.

This specification applies to portable and stationary arc-welding equipment of the transformer type for potentials up to and including 600v between conductors. It covers ventilation, enclosures, connections, insulation, switches, transformers, capacitors, terminals, etc. There are also tables of temperature rises and tables of sizes of welding cables.

CSA C22.2 No. 96: 1951 — Construction and Test of Power-Supply Cable for Use with Approved Portable Apparatus. $1.25.

This applies to cable intended for use with portable electrical apparatus operating at 600 v. or less. It deals with the qualities of the conductors, their grounding, their insulation, their testing, their marking, etc. It includes tables of construction, properties and dimension requirements of conductors, grounding wires and insulation.

CSA Z107: 1952 — Turn Signals for Motor Vehicles. 75 cents.

This standard divides turn signals into three categories: type one consists in flashing warning lights, type two consists in flashing or illuminated arrows while type three consists in semaphores. It gives general requirements, tests procedures and installation recommendations.

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Britain Builds Abroad; British Constructional Engineering in the Service of World Civilization 1850-1950: A Tribute to the Merchant Adventurer Spirit in the British Engineering Industry. Mark Joffe ed. London, Constructional steelwork export group, 1951. 276 pp., illus., 30/–.

British Industries Fair 1952. Birmingham, Birmingham Chamber of Commerce, 1952. 785 pp., 3/–.

Chemical Calculations: an Introduction to the Use of Mathematics in Chemistry. S. W. Benson. New York, Wiley, c1952. 217 pp., $2.95.

Dialogues Concerning Two New Sciences. Galielo Galilei. Henry Crew and Alfonso de Salvio tr. New York, Dover, Toronto, Macmillan, 1914. Special new paper ed., $2.00.

Electrical Engineering: The Theory and Characteristics of Electrical Circuits and Machinery, 6th ed. C. V. Christie. Toronto. McGraw-Hill, 1952. 675 pp., illus., $9.45.

Electrical Measurements. F. K. Harris. New York, Wiley, c1952. 784 pp., illus., $9.60.

Foundations of High Speed Aerodynamics: Facsimiles of nineteen fundamental studies as they were originally reported in the scientific journals, with a bibliography compiled by G. F. Carrier. New York, Dover, c1951. 286 pp., illus., $2.25.

Fundamentals of Electronics and Control. M. G. Young and H. S. Bueche. New York, Harper, c1952. 525 pp., illus., $7.20.

Industrial Heat Transfer. F. W. Hutchinson. New York, Industrial Press, c1952. 326 pp., charts, $7.20.

Introduction to the Geography of the Canadian Arctic. Ottawa, Department of mines and technical surveys, Geographical branch, 1951. 118 pp., illus., maps, 50c. (Canadian geography information series No. 2).

Matter and Motion. J. C. Maxwell. New York, Dover. 163 pp., illus., $1.75.

Methods of Analysis of Fuels and Oils. J. R. Campbell. London, Constable, Toronto, Longmans, Green, c1951. 216 pp., illus., $6.00.

Modern American Engineers. Edna Yost. Philadelphia, Lippincott, c1952. 182 pp., $3.00.

Phase Rule and its Applications, 9th ed. rev. and enl. Alexander Findlay. New York, Dover, c1951. 494 pp., diags., $2.30.

Surface Area and Volume of Dished Ends. D. E. W. Aldous. Manchester, Emmott, c1952. 23 pp., illus., 2/6.

TECHNICAL BULLETINS RECEIVED

American Society for Testing Materials. Annual index to standards: 1950.

... Special Technical Publications:

No. 114 — Symposium on bulk sampling. No. 115 — papers on evaluation of soaps and detergents. No. 118 — Symposium on structural sandwich constructions. No. 124 — Report on the elevated-temperature properties of stainless steels.

Australia. Commonwealth Scientific and Industrial Research Organization. Documentation Section. Pamphlets:

No. 1 — Australian scientific societies and professional associations, by G. J. Wylie and N. F. Lowe.

British Electrical and Allied Industries Research Association. Technical Reports:

No. B/T111 — Review of problems of H.V. D.C. transmission and future possibilities. No. L/T253 — Bound electronic states in solids, resulting from a "potential hill", by J. J. O'Dwyer. No. G/T255 — Gas-blast circuit-breakers. Effect of arcing on the mass-flow of air through the nozzle and on the nozzle pressure. First progress report by A. A. Hudson. No. L/T265 — Theory of barium titanate — Part 2, by A. F. Devonshire. No. M/T113 — A pulse generator producing 0.01 microsec. pulses, by S. F. Pearce and D. C. G. Smith. No. V/T109 — The incidence and avoidance of high resistance joints in steel conduit runs in service, by L. Gosland and E. E. Hutchings. No. W/t20 — Differential effects in high-frequency dielectric heating, by A. Morris Thomas. No. W/T22 — A problem in radial heat flow, by H. Goldenberg.

Canada. Department of Resources and Development. Reprints:

A quick method of computing a lumber tally, by G. E. Bell. (Reprinted from Timber of Canada, Nov. 1951). Gang-saw production higher in small log conversion, by G. E. Bell. (Reprinted from Canada Lumberman, Sept. 1951). The chemical compositions of Canadian woods, by L. P. Clermont and H. Schwartz. (Reprinted from Pulp and Paper Magazine of Canada, Dec. 1951).

Canada. National Research Council. Canadian Government Specifications:

No. 5-GP-13a — Leather; chamois. No. 22-GP-13 — Broom; floor, soft-head (with brace) 36-inch and 48-inch. No. 22-GP-14 — Broom; floor, soft-head 14-inch, 18-inch and 24-inch. No. 22-GP-15 — Broom; stable. No. 22-GP-16 — Brush; clothes. No. 22-GP-17 — Brush; boot polishing. No. 22-GP-18 — Brush; boot, cleaning. No. 22-GP-19 — Brush; hair. No. 22-GP-20 — Brush; button. No. 22-GP-21 — Brush; nail. No. 22-GP-22 — Brush; scrubbing. No. 22-GP-23 — Brush; deck scrub, and handle. No. 22-GP-24 — Brush; bannister and radiator. No. 22-GP-25 — Brush; dusting, baker's. No. 22-GP-26 — Brush; wire (flat), butcher's. No. 22-GP-27 — Brush; wire, painter's scrub. No. 22-GP-28 — Brush; pastry. No. 22-GP-29 — Brush; lacquer, goather, flat. No. 22-GP-30 — Brush; engine cleaning, conical. No. 22-GP-31 — Brush; filter-pack.

National Institute of Agricultural Engineering. Reports of Tests:

No. RT50/51007 — Parsons "Bull" farm tractor chains. No. RT52/51025 — Wallace "Universal" artificial manure distributor type 6AT. No. RT53/51035 — Potato planter: "The Smallford three-row automatic potato planter".

National Society of Professional Engineers. Executive Research Surveys:

No. 1 — How to improve engineering-management communications.

Princeton University. Industrial Relations Section. Research Report Series:

No. 86 — Retirement procedures under compulsory and flexible retirement policies.

United States. National Bureau of Standards. Building Materials and Structures Reports:

No. 128 — Atmospheric exposure tests of nailed sheet-metal building materials. No. 129 — Fire resistance of shutters for moving-stairway openings.

...Handbooks:

No. 48 — Control and removal of radioactive contamination in laboratories.

PAMPHLETS RECEIVED

Handbook on Radiography: A Manual on the Use of Radium and Cobalt 60 in Industrial Radiography. Ottawa, Eldorado Mining and Refining (1944) Limited, c1950.

Motion and Time Study Laboratory. Methods and Measurements. Storrs, University of Connecticut, 1951.

Productivity Report: Universities and Industry; Report of a Specialist Team which visited the United States of America in 1951. London, Anglo-American Council on Productivity, 1951.

Steel Castings Industry. Cleveland, Steel Founders' Society of America.

Yankee Iron: the story of the Eastern Malleable Iron Company. Naugatuck, Conn., the company, c1952.

CORRECTION

The April issue of the *Journal* carried a book note on **Fundamentals of Automatic Control** by G. H. Farrington, which stated John Wiley to be the publisher. The agent for this publication in Canada is British Book Service.

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Business & Industrial Briefs

A Digest of Information

received by

The Editor

Appointments and Transfers

British Ropeway Engineering.—British Ropeway Engineering Co., Ltd., has appointed Vulcan Iron and Engineering Ltd., of Winnipeg, Man., as sole manufacturing and selling representatives in Canada, United States and Mexico. This British company is internationally known as designers of aerial ropeways and cableways.

The Canadian company will maintain a ropeway engineering office at 132 Jarvis St., Toronto.

●

Stevenson & Kellogg. — Stevenson & Kellogg, Ltd., consulting management engineers, have moved their Montreal office to 4123 Sherbrooke St. W., Westmount, Montreal 6.

●

New Company.—The North American Cyanamid Ltd. has announced the formation of a new corporation, Chemical Construction (Inter-American) Ltd., with offices at 74 Wellington St. W., Toronto.

This new subsidiary of American Cyanamid Company will design and build chemical plants in Canada and all other nations of the western hemisphere except the United States.

The operations of the new company will parallel those of Chemical Construction Corporation, another Cyanamid unit which designs and builds chemical plants in the United States and throughout the world.

W. R. Geddes, who is assistant to the president of North American Cyanamid Limited, has been elected president of the new firm and Wm. P. Jones, formerly of Chemical Construction Corporation, has been named general manager.

●

A. R. McGinn.—A. R. McGinn, formerly Secretary Comptroller, has been appointed secretary-treasurer of Anaconda American Brass Limited of New Toronto.

●

A. B. McEwen.—Alan B. McEwen has been appointed western management representative of Canadian Industries Limited at Vancouver. He succeeds Lewis G. McNab who becomes management representative at Toronto after three years as the company's western representative.

●

Duncan G. Grant. — Duncan G. Grant has been named manager of a newly formed merchandising division of Dow Chemical of Canada, Ltd.

This new division will be responsible for merchandising and sales promotion of all company products, which include plastics, coatings, solvents, industrial and agricultural chemicals.

Mr. Grant is a graduate of the University of Toronto in engineering.

●

New C-I-L Chief Engineer. — R. B. Winsor has succeeded I. R. Tait, M.E.I.C., as chief engineer of Canadian Industries Limited.

Mr. Tait is continuing in the service of the Company in the capacity of consulting engineer.

Mr. Winsor was assistant manager of the chemicals department before his new appointment. Before joining C-I-L in 1929, as a project engineer at headquarters of the engineering department, he was with the International Paper Company of Newfoundland and W. I. Bishop Limited, Construction Engineers, at Limoilou, Quebec.

●

O. F. Elliott.—Owen F. Elliott has been named sales manager for industrial chemicals in Toronto and southwestern Ontario by Dow Chemical of Canada, Limited.

●

C. A. R. Snell.—C. A. R. Snell, who joined the Canadian Commercial Corporation in November, 1950, on loan from Canadian National Railways, and who has been deputy co-ordinator of the general purchasing branch, is now co-ordinator.

●

R. F. Mitchell.—R. F. Mitchell has been appointed maintenance engineer for Trail operations of the chemicals and fertilizers division of the Consolidated Mining and Smelting Company of Canada Limited.

●

F. W. Hore. — F. W. Hore has been named director of the small industries division of the Department of Defence Production. He has been assistant general manager of the Canadian Industrial Preparedness Association, and will be on loan from that organization.

●

Alemite Appointment. — The Alemite division of Stewart-Warner-Alemite Corporation of Canada, Limited, Belleville, Ontario, has appointed E. S. Stephenson & Co. Ltd., Saint John, N.B. as maritime distributor and service depot. The new distributors maintain offices in Saint John, Halifax, and Sydney.

The Alemite division of Stewart-Warner-Alemite Corporation manufacture a complete range of lubricating systems and equipment including fittings, hand guns, oil pumps, material handling pumps, centralized lubrication systems, Alemite oil-mist and the Stewart Warner electronic wheel balancer.

●

New Test Pilot.—Jan Zurakowski, will shortly join Avro Canada as test pilot.

Mr. Zurakowski is internationally known as a test pilot. Last year he evolved "the first entirely new aerobatic in twenty years."

New Equipment and Developments

Flame Detector. — Canadian General Electric Company Ltd., 212 King St. W., Toronto, has announced the development of a new flame detector designed to be of service for jet engine designers and engineers.

The detector was developed in the G-E General Engineering Laboratory in Schenectady, N.Y. It is intended to be used to study flame characteristics in heretofore inaccessible sections of aircraft gas turbines. For further information contact the special products section of C.G.E.

●

C.S.A. Requirements. — The Approvals Laboratories division of Canadian Standards Association has now finalized a set of Laboratory Requirements covering the construction and performance of high-voltage test sets. These test sets are intended for use by manufacturers of electrical equipment in apply-

ing the dielectric strength test, required under Part 2 of the Canadian Electrical Code. Full details regarding these requirements may be obtained by writing to F. R. Whatmough, chief engineer, CSA Approvals Laboratories, 77 Florence St., Toronto.

•

Airfoil Fan Blading.—The B. F. Sturtevant Company of Canada Limited, Hamilton, Ontario, has introduced its Airfoil blading in a new line of centrifugal fans thereby "Providing the highest efficiencies ever offered to large industrial fan users."

It is claimed that the new Airfoil blading demonstrated at tests showed a 92 per cent mechanical efficiency as compared to 84 per cent for the same fan equipped with conventional flat plate metal blades. The extra efficiency is obtained through smoother airflow over the whole surface of the blade and the minimum of turbulence. This blade design is especially suited to applications such as forced draft, where pressures (6 inches WG and over) are required.

•

New Plastics Agreement. — On April 10th an agreement was reached between Monsanto (Canada) Ltd. and Barringham Rubber & Plastics Ltd. of Oakville to provide a wider and more diversified service to plastic fabricators, furniture manufacturers and industrial consumers, of the products manufactured by Barringham. The agreement provides for the supply of "Ultron" vinyl chloride resin by Monsanto, together with technical assistance and co-operation in the development of radically new products in the Canadian vinyl plastic field.

•

New Hydro-Labour Agreement.—Climaxing a year described by Ontario Hydro Chairman Robert H. Saunders, as one of "helpful give-and-take and constructive leadership in labour relations", a revised wage agreement has been signed by Ontario and the Niagara Development Allied Council A. F. of L. on behalf of 18 Unions. The new agreement, covering 2,170 Commission employees and 860 contractors' employees engaged on the Niagara project, provides for an increase of ten cents an hour across the board, effective March 1st. Among those receiving the pay boost are tradesmen, camp staff, clerical and other employees. Other major items are covered by the agreement.

•

Dow Chemical Expansion. — A new plant which will bring Dow Chemical of Canada present expansion programme at Sarnia to over $17 millions has been announced by N. R. Crawford, president of the Company.

Of major importance is the announcement that an ethylene plant will be built at an estimated cost of nearly $3.5 million. An initial capacity of 100,000 lbs. per day will supplement the supplies of ethylene which Dow will continue to obtain from Polymer.

A new styrene plant has also been announced. Styrene monomer, to be produced at an estimated rate of 2 million pounds per month, will make possible increased production of Styron. Expansion of the present Styron unit is already under way. These expanded facilities will also allow for production of new types of Styron not previously made in Canada. Cost of the styrene plant is estimated at close to $4 million.

Also planned are further expansion for the development of chlorine required by both the glycol and solvents units. The new type plant, with enlarged brine treating equipment, will be built at a total cost of $2 million. This is in addition to the expansion of the present chlorine unit, just completed.

•

Government Buys Airport.—The Right Honourable C. D. Howe, Minister of Defence Production, announced on April 5th that an agreement had been concluded with the deHavilland Aircraft of Canada, Limited, under which the government will take title to the buildings and land presently owned by that company at Downsview airport, including 125 acres of land now under expropriation.

The Crown will make available approximately ninety acres of Crown-owned land on the south west limits of the airport on which the deHavilland company will build a new aircraft plant. The consideration payable by the Crown

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is $5 million covering the property acquired as well as the re-establishment of production facilities at the new site.

•

Walter Kidde Expansion.—The establishment of the Walter Kidde Nuclear Laboratories, Inc., with the primary objective of developing commercial atomic power, was announced in New York on April 15th.

The organization is the first privately-financed laboratory dedicated to research in nuclear power. It is an associate of other Kidde enterprises, which include Walter Kidde & Company, Inc., manufacturers of fire protection systems and pneumatic devices for aircraft and marine application.

•

British-made Capacitator Bank.—The first large capacitor bank ever to be supplied to Canada by a British manufacturer completed its first twelve months in service in September last.

This 15,000-kvar. 11-kv. bank, manufactured by British Insulated Callender's Cables, Ltd., is connected to the system of the Shawinigan Water and Power Company. It was something of an innovation in Canada in that it is built up from large internally fused tank-type units, each of which has an output of 250 kvar. The units are installed out-of-doors without weather protection, and were therefore subjected to the large seasonal variation in temperature which is normal in Canada. In order to check the performance of the bank, the capacitance of each unit was recently measured at site by means of a capacitance bridge, and results obtained were compared with the results of tests made in the factory immediately after manufacture. It was found that no observable loss of capacitance had occurred during the first twelve months of service.

A later installation involving a 20,250-kvar. 10-kv. bank supplied by the British company to the Aluminum Company of Canada, Ltd., was also tested about the same time, and equally satisfactory results were obtained.

•

Lamp Prices Reduced.—A reduction in the prices of 68 of the most widely-used General Electric incandescent and fluorescent lamps was announced by the Company early in April. The price reduction will bring retail prices to pre-war levels or lower.

•

Westinghouse Expansion. — Another unit of Canadian Westinghouse Company's great expansion programme is rapidly nearing completion in Hamilton, Ont. A four storey structure containing 192,000 square feet of floor space is being erected to provide the most modern facilities in Canada for the production of electronic equipment for defence purposes.

•

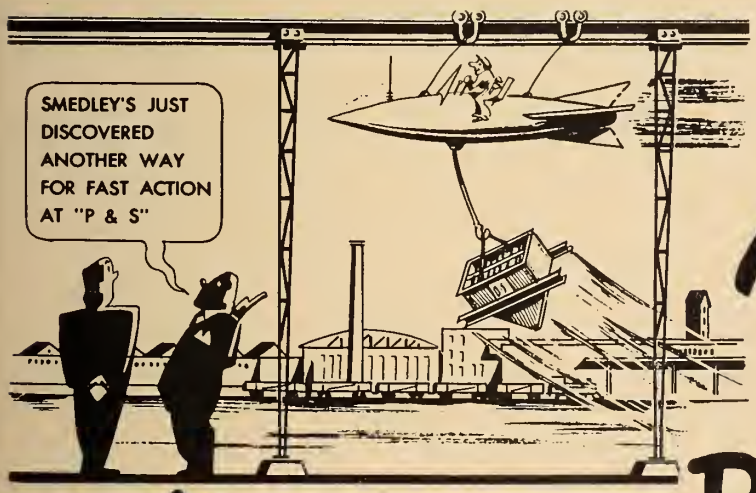
Plastic Tape. — Minnesota Mining & Manufacturing of Canada Limited has developed a new "SCOTCH" Brand Plastic Tape for use as lane marking and safety zone designation in industrial and defence plants. Claimed to have a life five times greater than that of other zone marking materials, this plastic tape is fast and economical. It comes in red, yellow, white, blue, green, black, brown and orange with widths up to 3 in. It is known as No. 471. Complete information may be obtained from the Company. The Postal address is P.O. Box 757, London, Ontario.

•

Pile Driving Hammers.—John T. Hepburn, Limited (construction equipment division), Toronto, Ontario, have recently expanded the line of contractors equipment which they now manufacture to include an open frame pile driving hammer of the differential acting type, to supplement closed type, under a licence granted them by (C. V. Adams) Canadian patentees. This new Hepburn hammer is capable of driving all styles of piles and by virtue of its distinctive design, combines the advantages derived from the heavy ram associated with the single-acting type with the high frequency blows peculiar to the double acting type.

•

Skid Shovels.—The Drott Manufacturing Corporation, Milwaukee, Wisconsin, is now in full production on the new line of Drott Skid-Shovels, built exclusively for International Tractors in these models and capacities: TD-9-1¼ yards, TD-14A-2 yards, and TD-18A-3 yards. Test models have been operating for a year-and-a-half, at Drott's north-



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ern Wisconsin proving ground, in every type of weather and under the toughest digging conditions.

•

Atlas Steel Expansion.—Sales of Atlas Steels Limited, Welland, Ontario, were $31,441,264 for the year ending December 31, 1951. This compares with $17,640,917 in sales for the year 1950.

Factors cited for the company's higher sales in 1951 were the growing industrialization of Canada, expansion of the nation's defence programme as reflected through other industries (Altas holds no contracts for government work), improvement in certain markets abroad and the increased demand for tool, specialty, mining and stainless steels made by the company.

Commenting on the Company's expanded programme of stainless steel production, R. H. Davis, president, said "Canada's first mill for the production of stainless steel strip is now in the process of erection at Welland. The Company now produces stainless sheet, bar, rod and wire.

"The reception accorded our stainless steels (in 1951) convinced the directors that the manufacture of stainless strip could be delayed no longer and last November they gave final approval to the long-planned programme of expansion," he said.

•

C.G.E. Vacations. — Canadian General Electric Company, Limited, have announced the following vacation periods during which time the firms will be closed: Barrie, Carboloy (Toronto), Cobourg, Davenport (Toronto), Lamp, Oakville, Peterborough, Royce (Toronto), Ward (Toronto), July 18th to August 5th. The Montreal firm and the Quebec City firm will be closed from July 18th until August 4th.

•

Kidde Portable Fire Extinguisher and Fire Detector. — A new, pressure-operated, dry chemical portable fire extinguisher has been announced by Walter Kidde & Company, Inc. The unit answers the need for a small, dry chemical unit which can be recharged easily in the field. It will be available through Kidde distributors in the near future.

The design of the portable unit permits it to be serviced following discharge by simply pouring five pounds of dry chemical into the powder chamber and, with the aid of a gas station or factory air line, charging the unit with 150 pounds of compressed air.

The new unit has the same diffusion discharge pattern which has proved so successful on the Company's twenty and thirty pound models.

The 5-pound dry chemical features trigger-type finger control, and its wall bracket has a quick-release type latch. Built into the extinguisher's handle is a gauge which shows the exact pressure carried by the extinguisher. Should the gauge fall below 150 pounds per square inch, additional pressure can be added to bring it up to the unit's designed operating pressure.

It weighs only ten pounds fully loaded, stands fifteen inches high and is four-and-one-half inches in diameter.

Another Kidde innovation is a sensitive, error-free, automatic, fire detecting device which has just been approved for installation in commercial aircraft by the Civilian Aeronautics Administration The equipment also has completed qualification tests by the United States Air Force and the Bureau of Aeronautics (Navy) for use on military aircraft. It is now in production at the company's plant at Belleville, New Jersey.

The system comprises a continuous, wire-like, fire-sensing element connected at one end to a monitoring control unit, which in turn provides the power for the system and the electronic circuit for actuating audible and/or visible alarms, which are located on the pilot's instrument panel.

•

Instrument Manufacturer's Conference.—Exchange of ideas and discussion of mutual problems in instrumentation for the measurement and control of industrial processes are the objectives of a five-day sales meeting of Foxboro export representatives scheduled for June 15th-20th at Vichy, France. Previous Foxboro conferences have been held at The Hague, Holland, in 1949, and at the Foxboro Head Office in Massachusetts in 1950.

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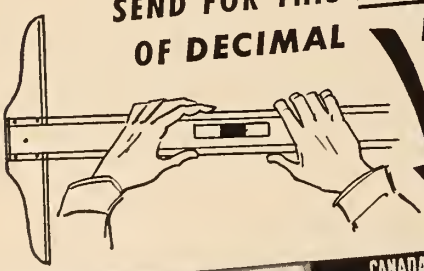

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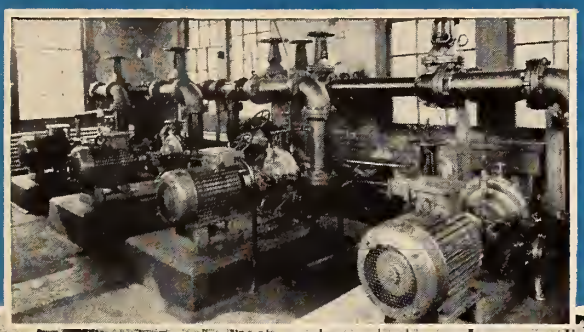

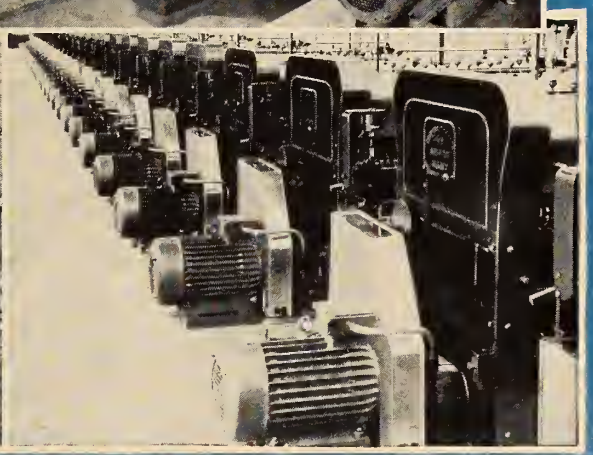

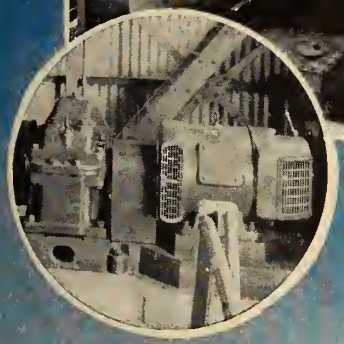

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Where excess moisture, dirt, dust or other severe conditions exist, Bepco totally enclosed fan-cooled NEMA motors are recommended. Their ribbed frames provide a greater cooling area which results in highly efficient cooling, so much so, that it is found on test the motors have a temperature rise not exceeding 50°C. This means more reserve capacity. The ribbed construction, which was pioneered by our "Lancashire" works over 20 years ago, eliminates all possibility of corrosion or choking.

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Peacock Brothers, Limited, Ville La-Salle, Quebec, are sole sales agents for Canada, and the Company maintains a manufacturing plant in Montreal.

•

Orenda Jet Engines. — Avro Canada Orenda jet engines have been chosen to power Sabres to give these Canadian-made fighters improved performance. The Sabre holds the present world's speed record of 670 m.p.h. On a recent flight from Toronto to Montreal the Orenda-powered Sabre flew at an average speed of 665 m.p.h.

•

Construction Forecast. — "Further cuts in the 1952 building construction programme are likely if costs are increased in line with present wage demands in many Canadian cities", said P. G. Wilmut, president of the Canadian Construction Association, in Montreal, recently.

Mr. Wilmut stated that, while a new wage agreement covering construction workers in Montreal had been completed, negotiations were still under way in other centres. Wage-rate increases requested averaged from 25c to 40c an hour in most instances but a considerable number of demands ranged from 50c to over $1.00 an hour.

"Long-term prospects for building construction are excellent", stated Mr. Wilmut, "but this year the emphasis will be on heavy engineering work. Building construction will be down because of the substantial drop in housing and the postponement of many commercial and industrial projects due to steel controls, credit restrictions and deferred depreciation regulations. A recent Federal Government white paper on the 1952 investment programme estimates that housing volume will be some 15 per cent below last year's level and that building construction in general will show an appreciable decline. Contracts awarded during the first quarter this year in the building construction category were 36 per cent below the level for the same period last year".

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Hole Punching Units. — Wales-Strippit of Canada Ltd., 344 Sherman Avenue North, Hamilton, Ontario, have produced a bulletin which illustrates and describes the new Hydra-Strip Hole Punching Units designed to punch and strip materials up to ¾ in. thick. For copies of the bulletin, write to the Company and ask for bulletin HS.

•

Gyratory Sifters. — Canadian Allis Chalmers (1951) Ltd., P.O. Box 37, Montreal, Que., have issued a bulletin "Low-Head" Gyratory Sifters No. 07B6124B.

The bulletin features the "Low-Head" gyratory sifter, which is designed to separate from two to eight material sizes in one sifting operation. Available in either wood or all-metal construction, the sifter has screens which are readily accessible through a convenient side opening. The bulletin contains diagrams showing the arrangement of seven sieves for two and four-product sizes, and has a table of wire cloth screen specifications and mesh comparisons. Write to the Company for copies.

•

Ferranti Regulators.—Ferranti Electric Limited, Mount Dennis, Toronto 15, have issued a new bulletin on Ferranti Regulators 6 and 12-step for rural line and light duty feeders.

These 6 and 12-step regulators are built in line current ratings up to 200 amperes for 2400/4160 volt circuits, and in lower current ratings for the higher voltages. The booklet is well produced and contains 20 pages of information and photographs. To obtain copies write to the Company.

•

New Faceshield.—Mine Safety Appliances Co. of Canada Limited, 500 MacPherson Avenue, Toronto 4. Ont., have

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McAvity-Milwood Gate Valves—

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Welding Article. — Davey, Paxman & Co. Ltd., Standard Iron Works, Colchester, Essex, England, have issued a bulletin describing welding and fabrication work at their plant. The bulletin is a reprint of an article which appeared "Welding and Metal Fabrication" November 1951. For copies of this publication write to the Company and ask for publication No. R1305.

●

Film Catalogue.—Crawley Films Limited, 21 Dundas Square, Toronto, has issued a directory of sponsors of free 16-mm. sponsored films in Canada.

It is a small booklet listing 185 organizations from which films can be obtained for the asking. The bulletin contains a brief description of all these films which are offered and addresses to which applications for the use of films should be made as given. Copies may be obtained by writing to the Company.

●

Kato Bulletin.—Kato Engineering Company, Mankato, Minnesota, have issued a bulletin on their a-c generators, motor type generators, converters d-c to a-c and power plants a-c to d-c. For copies of this four page bulletin write to the Company at the address given above.

●

Canada's Power Station Output.—Canadian General Electric Company has recently published a pamphlet showing in graph form, Canada's power station output for the past thirty years.

The chart not only indicates total output but the "Firm" power curve which is one of the most reliable indices in the economic life of our nation. An interesting illustration on the pamphlet shows a cross-section drawing of a giant generator. Requests for copies of this pamphlet (No. 4089T) should be sent to any C.G.E. office.

●

"Sylvaply News".—Sylvaply News is the title of a four page bulletin which is issued at regular intervals by MacMillan & Bloedel Limited, 837 West Hastings Street, Vancouver, B.C. This bulletin will be very useful to readers who make use of plywood. To be placed on the mailing list for regular receipt apply to the Company.

●

Coal Mining Equipment. — Canadian Allis-Chalmers Limited, have issued a sixteen page guide which will be of particular interest to engineers in the coal mining industry.

The bulletin gives factors to be considered when selecting vibrating screens, centrifugal pumps, car shakers, V-belt drive equipment, electrical equipment. It describes their construction and applications. In each instance, the guide gives numbers of bulletin which provide a more complete description of the equipment covered.

Copies of the "Allis-Chalmers Section Guide for the coal industry" No. 25B6280D can be obtained by writing to Canadian Allis-Chalmers (1951) Limited, P.O. Box 37, Montreal, Que.

●

Worm Gearing. — Hamilton Gear and Machine Company Limited, 960 Dupont Street, Toronto 4 have issued a new technical bulletin "Worm Gearing and Hob List (2) Single Thread above 9/16" Pitch". For copies of the bulletin apply to the Company.

●

Oxy-Acetylene Welding. — "Dominion Oxygen Tips" is the title of a bulletin issued at regular intervals by Dominion Oxygen Company Limited, 40 St. Clair Ave. E., Toronto 5. The April issue contains articles on "Silver-Brazing of Stainless Steel"—"A Guide for Straight-Line Cutting"—"Getting Ready to Paint", and other interesting items designed to keep the welder informed on new developments. To be placed on the mailing list for regular receipt write to the Company.

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"R. H. Nichols Newsletter". — R. H. Nichols Limited 2781 Dufferin St., Toronto 10, Ont., publish a newsletter each month. It contains information on the product distributed in Canada by the company. To be placed on the mailing list, write directly to the company.

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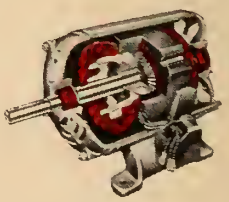

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Canadian Petrochemical Developments

by

F. K. Rogers

Department of Chemical Development,
Shawinigan Chemicals Limited, Montreal.

A paper presented to the Montreal Branch of The Engineering Institute of Canada, February 19, 1952.

The term "petrochemical" has been coined recently and as yet has not appeared in the dictionaries. A good definition is that a petrochemical is any product of petroleum other than fuels, lubricants, waxes and asphalt. This includes all the oxygenated and chlorinated organics commonly called petrochemicals, also such things as sulphur and ammonia from natural gas, and carbon black.

In discussing petrochemicals we have to determine arbitrarily at what point a petrochemical loses its identity; it would be absurd to include the investment in the tire industry in statistics on petrochemicals, just because the tire industry uses a proportion of synthetic rubber from petroleum.

The petrochemical industry in the United States is some 25 years old. There it has been stimulated by the huge potential of the domestic market, and by cheap petroleum in large quantities; you cannot produce primary petrochemicals on a small scale. Without these stimuli the industry in Canada lagged. Here it is about ten years old, but is now really getting into its stride.

Table I is a list of the Canadian petrochemical plants either built, building, or announced, together with the investment involved.

Some comments on the data of Table I are in order.

Consolidated Mining and Smelting Co.—Alberta Nitrogen Division

The first petrochemical plant in Canada was the Alberta nitrogen plant at Calgary, which was purchased by the Consolidated Mining and Smelting Co. after World War II. This plant is designed to produce 240 tons of ammonia per day, some of which is converted to 180 tons of ammonium nitrate. Almost all of the product is at present being used in fertilizer manufacture. The 'prilling' process, developed by the company, is used to produce ammonium nitrate in a form which is less inclined to cake and is more stable than ammonium nitrate made by older processes. The balance of the ammonia is shipped from Calgary to the Consolidated Mining and Smelting plant at Trail for conversion to ammonium sulphate, also for fertilizer.

Any industry which has grown from nothing to an investment of over $140 million in about ten years deserves more than a passing glance from engineers. Such an industry is petrochemicals. Mr. F. K. Rogers, of the chemical development department of Shawinigan Chemicals Limited, tells the story of its origin and growth and ventures a few predictions as to its future in this paper, which was originally delivered before the Montreal Branch.

Polymer Corporation

The second petrochemical plant in Canada was the Polymer Corporation, a Crown company, at Sarnia, which went into operation late in 1943. Light ends are received from the adjacent Imperial Oil refinery and the ethylene, butylene and isobutylene extracted. Ethylene is reacted with benzene, obtained from the coal tar distillation industry, to produce ethyl benzene which is dehydrogenated to styrene. Butylene is dehydrogenated to butadiene, which is copolymerized with styrene to produce GR-S type rubber. Styrene is sold to polystyrene manufacturers. Ethylene is sold to the Dow Chemical Co. for ethylene glycol manufacture, and services are sold to industries in the area. Butyl rubber is produced by copolymerizing isobutylene and a small quantity of isoprene. This plant is a giant among the petrochemical producers of this country. In the year ending March 31, 1951, production was of the order of 65,000 tons of synthetic rubber, employees numbered over 2,000 and annual sales were over $35 million.

Dow Chemical Company of Canada

The first privately-built petrochemical plant in Canada is the Dow Chemical Co. plant at Sarnia. In 1947 it began production of polystyrene from Polymer's styrene, and in 1948 commenced production of ethylene glycol from Polymer's ethylene, at the rate of 1,500,000 lb. per month. Glycol is produced by the chlorhydrin process, and, since insufficient chlorine could be purchased for the manufacture of glycol, a mercury-type caustic chlorine plant was erected, and production is now up to 125 tons of chlorine per day. In the process of manufacturing ethylene glycol, one pound of ethylene dichloride is produced for each three pounds of ethylene glycol. As an economical means of disposing of this by-product, a plant to produce carbon tetrachloride, trichlorethylene, perchlorethylene and hydrochloric acid from ethylene dichloride was constructed and is now in operation.

Current plans call for the construction of an ethylene plant, utilizing the gases from the Canadian Oil Company's new refinery; for the production of styrene monomer, and for the manufacture of methyl and ethyl chlorides and of ammonia. The rate of growth of this operation has been spectacular and Dow ranks high among Canadian petrochemical producers.

Dominion Tar and Chemical Company

The Dominion Tar and Chemical Co. is currently building a plant to produce ethylene oxide and ethylene glycol in Montreal East. Its plant is adjacent to the McColl Frontenac refinery from which it is purchasing light ends and removing the ethylene. The chlorhydrin process is to be used for glycol production, and chlorine is to come from the company's caustic chlorine plant at Beauharnois. Some of the ethylene oxide produced will be absorbed by an associated company, Chemical Developments of Canada, which

Table I — Canadian Petrochemical Plants

Company	*Principal raw materials*	*Petrochemical products*	*Investment (first cost)*
Consolidated Mining & Smelting Co.* Alberta nitrogen plant	Natural gas	Ammonia and ammonium nitrate	$ 11,000,000
Polymer Corp.,* Sarnia, Ont.	Refinery light ends	Copolymer and butyl rubbers, ethylene, styrene, isobutylene	62,000,000①
Dow Chemical Co.,* Sarnia, Ont.	Ethylene, styrene, refinery gases, salt	Ethylene glycol, chlorinated solvents, polystyrene, methyl and ethyl chlorides	15,000,000②
Dominion Tar and Chemical Co., Montreal, Que.	Refinery light ends	Ethylene glycol	5,000,000
Canadian Chemical Co. Edmonton, Alta.	Propane and butane	C_1 to C_4 oxygenated hydrocarbons, cellulose acetate flake fiber and yarn, pentaerythritol	23,000,000③
Shell Oil Co.,* Jumping Pound, Alta.	Hydrogen sulphide from natural gas	Sulphur	500,000
B.A. — Shawinigan, Montreal	Cumene from benzene and propylene	Phenol and acetone	4,000,000
Shell Oil Co., Montreal	Propylene	Isopropanol and acetone	3,000,000
Bakelite Co., Belleville, Ont.	Methanol	Formaldehyde	2,000,000④
Royalite Oil Co., Okotoks, Alta.	Hydrogen sulphide from natural gas	Sulphur	500,000
St. Maurice Chemicals, Varennes, Quc.	Methanol, acetaldehyde	Formaldehyde and pentaerythritol	2,000,000
Godfrey L. Cabot Co., Sarnia, Ont.	Oil fraction	Oil-type furnace black	1,000,000
Canadian Industries, Edmonton, Alta.	Ethane	Polyethylene	13,000,000
			$142,000,000

* Now in operation.
① Investment in facilities for production of rubber is included.
② Investment in chlorine plants and ammonia plant excluded, since not of petroleum origin. Investment in service facilities not included.
③ No data on breakdown investment in petrochemical and cellulose acetate facilities has been made public. The $23,000,000 figure is roughly deduced from the volume of feed stock (75,000 U.S. gals.) vs. the volume at Bishop, Texas (200,000 U.S. gals.) The capital cost of the latter was $21,000,000 in 1948. The 0.6 factor for scaling down capital costs is used, and inflation compensation made by applying the Engineering News Record construction cost indexes for 1946 and 1951.
④ No figure on capital expenditure has been made public and this is the author's guess.

manufactures non-ionic type detergents with an ethylene oxide base. This marks the first venture of this traditional coal tar processor into the petrochemical field.

Canadian Chemical Company

Of the petrochemical plants now building, the $52 million Canadian Chemical Co. plant under construction by the Celanese Corp. of America dwarfs all others. Propane and butane are to be oxidized under pressure and with a controlled quantity of air to a mixture of oxygenated hydrocarbons, including formaldehyde, methanol, acetaldehyde, acetone, isopropyl alcohol, normal propyl alcohol, butanol and isobutanol, propylene oxide, propylenes, dipropylene glycols, and propionaldehyde.

Some solvent mixtures also are to be produced, formaldehyde is to be purified in a separate refining system, and acetaldehyde is to be oxidized to acetic acid. Acetic acid is to be converted to acetic anhydride, probably via ketene, and the anhydride reacted with cellulose to form cellulose acetate. The acetone will be used as a cellulose acetate solvent in the conventional process for manufacture of cellulose acetate yarn and fibre from flake cellulose acetate.

Some of the acetaldehyde and formaldehyde will be converted to pentaerythritol; a production of a million pounds per month is planned. The products of this plant are to be marketed in Canada and in export markets open to Celanese, with their widespread foreign manufacturing operations. The cellulose will be brought from the company's Columbia Cellulose mill at Prince Rupert. 25,000,000 lb. of flake are to be produced per year, of which 15,000,000 lb. are to be converted to staple fibre and filament yarns. This plant will more than double the production of cellulose acetate in Canada, and convert us into a nation with a large exportable surplus.

Shell Oil and Royalite Oil Companies

Both the Shell Oil Co. and the Royalite Oil Co. are constructing or have constructed plants for the recovery of sulphur from hydrogen sulphide contained in natural gas. Shell's plant is now operating. In both of these plants hydrogen sulphide and carbon dioxide are scrubbed by monoethanolamine from sour natural gas and subsequently regenerated from the monoethanolamine by heating. Air in sufficient quantity to oxidize one-third of the hydrogen sulphide to sulphur dioxide is introduced with the gas into a furnace, the mixture is then cooled and passed over two catalyst beds in series with an intercooler in which the remaining hydrogen sulphide reacts with the sulphur dioxide to form elemental sulphur.

These plants are designed to produce 30 long tons of sulphur per day, a small but valued contribution to the sulphur shortage, and a happy solution of a serious waste disposal problem.

B.A.-Shawinigan Co.

In the B.A.-Shawinigan plant in Montreal East, cumene is to be oxidized to cumene hydroperoxide by air oxidation. The cumene hydroperoxide is then cleaved in the presence of sulphuric acid to acetone and phenol. This process was patented independently by the Hercules Powder Co. in the United States and by the Distillers Co. in Great Britain; B.A.-Shawinigan is licensed under the patents of these companies. The plant is designed to produce 13,000,000 lb. of phenol and 8,000,000 lb. of acetone per year. Some quantity of alpha methyl styrene, acetophenone and mesityl oxide will be produced as well.

Cumene was produced during World War II for a component of aviation gasoline at the B.A. oil refinery by alkylation of benzene with propylene; the alkylation unit used then is now to be used to produce cumene for B.A.-Shawinigan.

This method for producing phenol has become popular, as it avoids the use of chlorine and of sulphuric acid. Plants are now being built by the Barrett Co., the Standard Oil Co. of California and the Hercules Powder Co. in the United States.

Shell Oil Company

The Shell Oil Co. has announced construction of a $3 million plant to

manufacture isopropanol and acetone from propylene at its Montreal East refinery. Production will total 21,000,000 lb. annually. The method to be used has not been announced. There are two ways in which isopropanol is produced industrially from propylene: one is by direct catalytic hydration by steam, and the other by intermediate production of sulphate followed by its hydrolysis. There is little to choose between the two processes from the point of view of costs, but the sulphuric acid shortage may make direct hydration the more desirable. Some isopropanol will be sold as such and the rest will be dehydrogenated to acetone.

Bakelite Company

The Bakelite Company is constructing a plant for the manufacture of formaldehyde from methanol, which will be purchased. The Bakelite Co. consumes large quantities of formaldehyde in the manufacture of phenol formaldehyde resins. The construction of this plant constitutes a step in consolidating their raw material position.

St. Maurice Chemicals

St. Maurice Chemicals is owned, half by Shawinigan Chemicals and half by the Heyden Chemical Co. It is building a plant to produce 3,000,000 lb. of pentaerythritol and 30,000,000 lb. of formaldehyde annually. The formaldehyde will be produced by the oxidation of methanol. Pentaerythritol will be produced by the condensation of one mol of acetaldehyde and four mols of formaldehyde. One mol of formaldehyde acts as a reducing agent and is oxidized to formic acid, which appears as sodium or calcium formate under the alkaline conditions of the reaction.

This plant is to be built on the south shore of the St. Lawrence River just below Varennes.

Godfrey L. Cabot Co.

The Godfrey L. Cabot Co. has announced the construction of a $1 million oil-type furnace-black plant at Sarnia. The black will be produced by the oxidation of oil in a deficiency of air. This plant will use a special oil cut which will be brought from the United States. Furnace blacks, particularly those produced from oil, have been gaining in popularity as reinforcing fillers for rubber. Of course they compete with channel and furnace blacks produced from natural gas. This will be the first production of these rubber-type blacks in Canada.

Canadian Industries

Canadian Industries have announced the planning of a polyethylene plant at Edmonton which is to cost $13 million and will produce 12,000,000 lb. annually of polyethylene flake. They already operate a polyethylene film plant at Shawinigan Falls and construction of this plant in the West will make them independent of polyethylene imports. Ethane is to be cracked to ethylene, which is then to be polymerized under extremely high pressure conditions, about 30,000 lb. per sq. in., to polyethylene. The high capital cost of this plant can be largely attributed to the cost of the high-pressure equipment required.

The development that Canadian Industries are undertaking at Maitland, in producing nylon salt for their Kingston plant, may be termed a petrochemical development. No announcement has been made of the raw materials which may be used. However, the du Pont Co. uses cyclohexane as a starting material, as it may be oxidized in two steps to adipic acid, which in turn may be converted into hexamethylene diamine via adipamide and adiponitrile. Nylon is the condensation product of adipic acid and hexamethylene diamine. There is also a possibility that butadiene from petroleum might be used as a source of hexamethylene diamine via 1,4 dichlorbutane and adiponitrile.

Sherritt Gordon Mines are promoting a $17 million nickel refinery at Edmonton to process ores from their deposits at Lynn Lake. The process involves extraction with an ammoniacal solution. Ammonia for this operation will be produced from natural gas and there will be ammonium sulphate available as a byproduct.

Other Considerations

The organic chemical industry in Canada cannot be analysed by reference to publicly published statistics, as in most cases production is in the hands of no more than two firms. We may, however, refer to the history of the industry in the United States and expect to parallel it roughly. Recently Mr. H. B. McClure, a Vice-president of Carbide and Carbon Chemicals Corp., said that the synthetic aliphatic chemical industry in the United States is increasing in production by a factor of 1.8 every five years, and that production at the end of 1950 amounted to 16,000,000,000 lb. He included oxygenated and chlorinated products only in this total, not only the finished products, but also the intermediates; e.g. methanol used in formaldehyde manufacture and the formaldehyde resulting both appear. Of the total production of synthetic aliphatics in the United States, 75 per cent is derived from petroleum; in 1945 only 50 per cent came from this source. This segment of the petrochemical industry in the United States now represents an investment of over a billion dollars.

The aliphatic chemical industry in Canada has followed a quite different path. In this country we have not until recently been blessed with a large native supply of petroleum, so our industry has been built up on the basis of cheap hydroelectric power, waste sulphite liquor from the pulp and paper industry, and the products of fermentation. Hydroelectric power has fathered the carbide industry, from which a host of organic chemicals is now produced, and a substantial part of our ethyl alcohol is produced from sulphite liquor. Our organic chemical industry will continue to reflect the differences between our economy and that of the United States.

In the United States there is a marked tendency for the petrochemical industry to migrate to the source of their petroleum, in the southwest. In 1940, of a total of 35 petrochemical plants, five were located in the southwest. In 1951, of the total of 88 petrochemical plants, 47 were located in the southwest, with about 34 clustered on or near the gulf coast.

This migration to cheap and abundant raw materials is starting in Canada, as witness the Canadian Chemical Co. and Canadian Industries' plants planned or under construction near Edmonton. However, Alberta is not another Texas. It is a Texas with no tidewater, far removed from the markets of eastern Canada, and with a smaller market, under the existing tariff structure.

The raw materials in which the petrochemist is most interested are the low molecular weight paraffins and olefins up to C_4. These are available from refinery gases or from dry or wet natural gas.

An oil refiner will probably charge for refining gas on the basis of its fuel value. In the case of a refiner in Eastern Canada, where natural gas is not available, a refiner's operation is roughly in balance as regards production of gas and its consumption as fuel for raising steam and cracking. The gas he sells must be replaced by coal or oil, and he will charge at a rate which will bear

(Continued on page 620)

Possibilities of the Heat Pump in Canada

by

E. A. Allcut, M.E.I.C., *Professor, and*

F. C. Hooper, *Lecturer*

Department of Mechanical Engineering, University of Toronto.

A paper specially prepared for presentation at Heat-Transfer Discussions, London, England, September 11-13, 1951.

Heat pumps are extensively used in Switzerland, South America and parts of the United States, where seasonal heating and cooling loads are approximately equal, where there is a suitable heating or cooling load, and plenty of cheap power.

Since 1948 the Ontario Hydro and the University of Toronto have been carrying out a research project on the suitability of heat pumps for dwellings in Canada; and the Defence Research Board and certain of the mining companies have assisted research there on installations in mining areas and remote Arctic regions. Conclusions are that the pumps are more economical than fuel under certain conditions.

The use of the heat pump in different countries and in various circumstances has been described in many papers and articles, but most of the installations described are located in regions where the existing temperature ranges are exceptionally favourable for economic application.

Accordingly, the more important stationary installations occur in Switzerland, Central and South America and certain parts of the United States. It is significant that, of approximately 1,400 heat pumps in the U.S.A., the great majority are stated to be situated in a rather narrow band across the continent, and are confined to those regions in which the seasonal heating and cooling loads are approximately equal.

The question naturally arises regarding the extent to which the width of this band can be increased in terms of latitude and climate. The following analysis is intended to apply to machines employed primarily or solely for the heating of buildings or for other similar purposes, where climatic conditions are predominant factors. The applicability of the heat pump under conditions similar to those existing in Canada has been studied by the authors in relation to three typical problems, namely, space heating in an industrialized area, space heating in Arctic regions, and industrial application in mining operations.

Analysis of the Problem

The following factors enter in varying degrees into all of these applications:

1. There must be available a convenient, adequate, and reliable source of heat.

2. The temperature difference between the source of heat and its ultimate destination should be as small as possible.

3. There must exist a suitable heating or cooling load (or some combination thereof) and the conditions of operation must be reasonably safe for the personnel and property concerned.

4. There must be available an adequate and suitable supply of power (or its equivalent) at a cost that is appropriate to the circumstances.

5. The equipment must be of such a size, form, weight, and simplicity that the resulting capital cost is reasonable.

6. The general economic and industrial environment must be appropriate for installation and maintenance purposes.

Space Heating in Urban Areas

Most of the heat pump installations in North America are in urban areas and, as the Province of Ontario is an acute fuel area, an investigation into this problem was considered to be particularly timely. For domestic heating and other similar applications, the machine must be small, compact, self-contained and available at low cost. Such machines are almost invariably driven electrically by power obtained from a public utility. In Ontario (and in some other provinces) restricted hydro-electric generating capacity imposes obvious limitations to the possible number of such installations.

The nature of the load curve and particularly the timing and duration of the peak loads, both at the generating plants and at the pump itself, are crucial factors which may be decisive. The desirability of the use of low cost "off peak" power is evident, and this could be achieved by the provision of suitable heat storage. The initial cost and size of such storage, however, may be prohibitive.

In this part of Canada the heat is preferably derived from ground coils although, in some locations outside Canada, well water and air are used as sources of heat. In the opinion of the authors, water and air are of limited utility for this purpose in Canada because of the falling water table and low atmospheric temperatures. The summer cooling load moreover is relatively small (in Ontario 15 per cent of the winter heating load) and this restricts the economic benefit derivable from the dual application.

Further, only a small proportion of the area of Canada has a soil coverage suitable for the installation of ground coils but, happily, these locations usually coincide with the populated areas. The nature of the ground and its thermal properties largely control the expense of excavation and installation and the length of coil required. In addition

to these factors, limitations of space, the effect of heat extraction on ground temperature and vegetation, frost heaving of foundations and local concentrations of electrical power demand must be taken into account.

The lack of ventilation which is normally provided by draught from the chimney may sometimes be undesirable. It seems probable that, where the local conditions permit, the heating of blocks or groups of buildings from a single pump may be appropriate. As the cost of the pump and of its installation in an ordinary house (at present) is about three or four times that of a furnace using fuel, it is suggested that individual pumps may preferably be owned by the local public utility corporation, who will then rent them to householders on the basis of the amount of heat supplied.

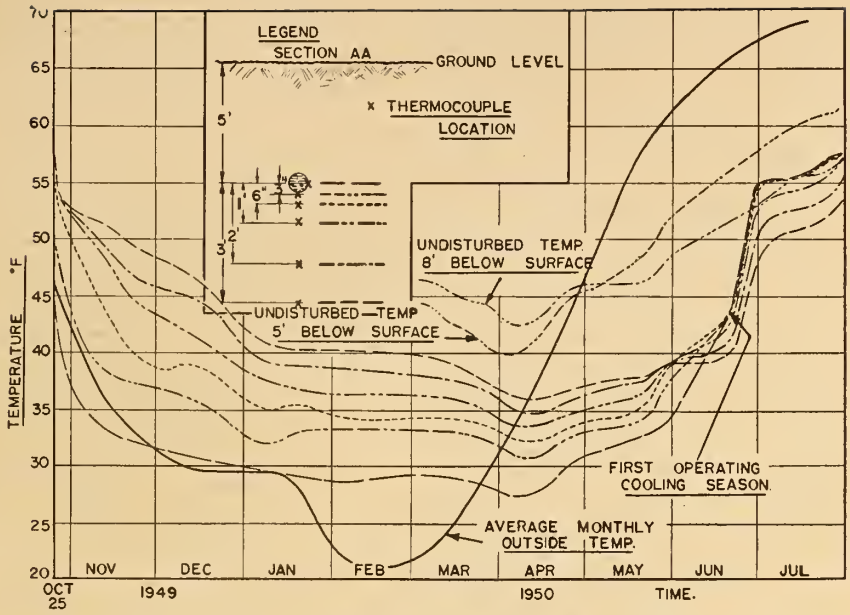

Fig. 1. Ground Temperature at Vertical Sections.

("First operating, cooling season" indicates the date at which the heat pump was first used for cooling the house instead of heating. This accounts for the inversion of the ground temperature which occurred at that time.)

The Port Credit Heat Pump

Because of the intimate concern of public utilities with future applications of the heat pump, a joint research project was instituted in 1948 by the Hydro Electric Power Commission of Ontario and the Department of Mechanical Engineering of the University of Toronto. The conditions of installation were specifically chosen to represent the conditions existing in an average Ontario home.

A new house was constructed at Port Credit, near Toronto, consisting of five rooms arranged in one and a half storeys. The walls were of concrete block faced with stucco, insulated with aluminum foil on the back of ⅜-in. "gyproc" board and also with ¾-in. of wood-fibre board. There was a ½ in. air space between the gyproc and fibre board; the foil formed one side of the air space. The coefficient of heat transfer (air to air) was 0.13 Btu/sq. ft. (deg. F/hr.) and the estimated heating load was 54,000 B.t.u./hr. with an outside temperature of minus 10 deg. F.

The two ground coils used in the first test season were each 300 ft. long, and consisted of ¾ in. o.d. copper tubing buried in fine sand at a depth of 5 ft. The coils were 6 ft. apart. The thermal conductivity of the dry soil was 2.0 B.t.u./sq. ft. (deg. F/in. hr.), but, as the coils were located at ground water level, the moisture content averaged about 15 per cent of the dry weight. This factor, however, was so variable that a separate and detailed study is being made of ground coil performance. The general conditions of operation are illustrated by the curves in Fig. 1, but readings were actually taken with 60 thermocouples during the winter of 1949 and the spring of 1950.

It should be remarked that the greater part of the winter in question was comparatively mild, but, in view of the fact that severe weather occurred during January and February, the seasonal heat load was about normal, being 6,870 degree-days (based on 65 deg. F.). A commercially available heat pump having a 3 hp. motor and employing Freon 12 as refrigerant was installed in the basement. Heat was absorbed through a heat exchanger from an ethyl alcohol-water mixture which was circulated by a pump through the ground coils, the latter being connected in parallel. The heating system circulated warm air through the house and the air was heated both by the refrigerant and, whenever necessary, by three electrically heated panels, each having an electrical input of 2,000 watts.

The data shown in Fig. 2 for Feb. 20 and 21 represent very cold days, while those shown for Feb. 23 represent a fairly typical February day. The amount of auxiliary

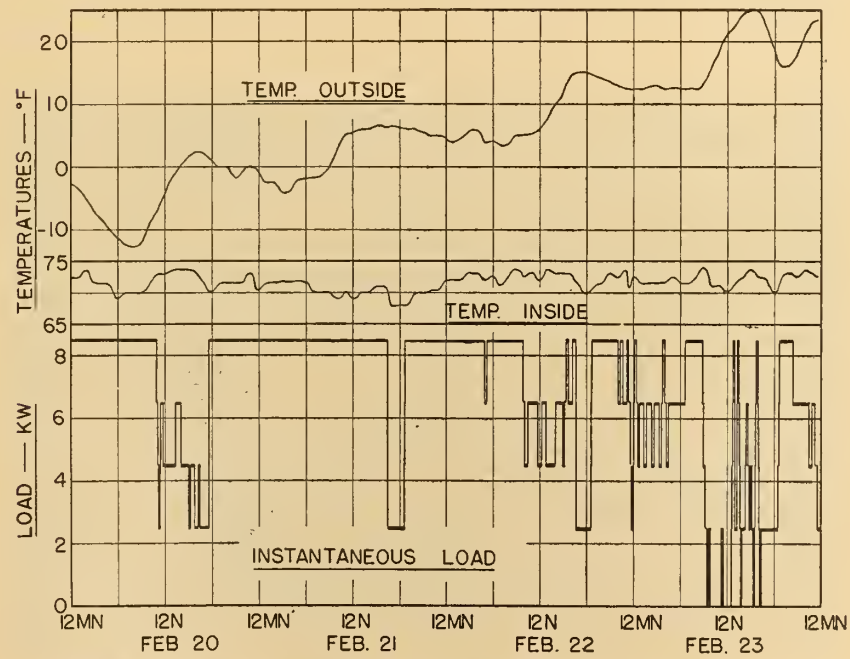

Fig. 2. Load and Temperature Curves for Port Credit Heat Pump.

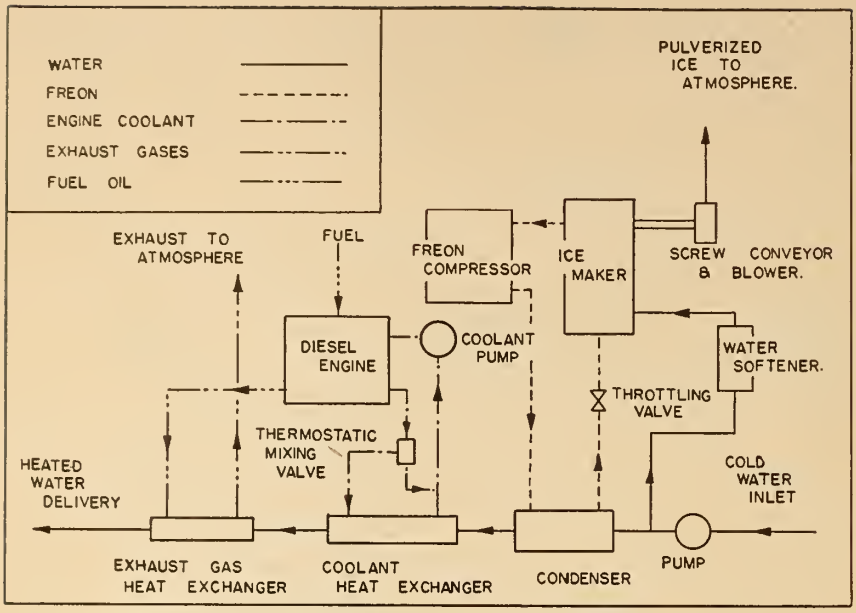

Fig. 3. Fluid Flow Diagram for "Arctic" Heat Pump.

heating required in each case is clearly indicated. During this period, the temperature of the air in the house was maintained automatically between 67 and 73 deg. F. It should be noted that the supply of electrical energy to the resistance heaters was cut off automatically every day during the electric peak load period from 4.30 to 6.30 p.m.

Separate readings were taken of the power supplied to the heat pump, the circulating pump and the hot air fan, so that both the gross and net coefficients of performance could be calculated. Continuous records were taken of atmospheric temperatures, room temperatures, and the supply and return temperatures of the alcohol-water mixture. Ground temperatures were observed twice weekly. Meter readings were also taken twice weekly giving the average rate of circulation of the alcohol-water mixtures. The results of those studies are given in Table 1.

Table I — Over-all Coefficient of Performance (Heating) for Period Sept. 1949-June 1950

Degree-days 6870 (from 65 deg F)

Gross (not including auxiliaries)	2.47
Net (including power to circulating pump)	2.30
Net (including pump and ventilating fan)	2.17
Net (including pump, fan and electric heaters)	1.83
Mean temperature of fluid leaving ground coil and entering heat pump (average for Sept.-June)	29 deg F
Average rise of temperature of fluid in ground coils	4.2 deg F

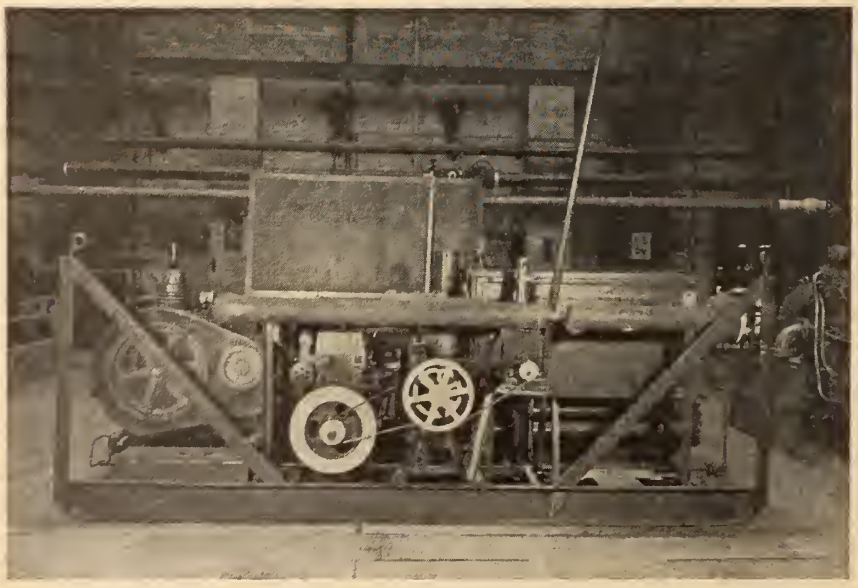

Fig. 4. Photograph of Arctic Heat Pump.

This work was continued during the summer of 1950 and the heating season of 1950-51. The results already obtained indicate that the cost of electrical energy actually used was $137 for the season, compared with an estimated cost of fuel for an oil burning furnace of $177. The initial cost of the heat pump installation, however, is about $1,600 more than that of an oil furnace of the same capacity, so that the annual saving of $40 represents only 2½ per cent return on the additional investment.

It would appear, therefore, that the widespread use of the heat pump for domestic heating under these conditions is improbable. There is, however, the saving circumstance that summer cooling may be obtained with the same apparatus and, if the cost of this service is compared with that of a constantly operating air conditioning system of the conventional type, the heat pump appears to be the more economical of the two.

Sufficient evidence is not yet available, however, to enable the relative maintenance costs to be compared. As mentioned above, power costs could be substantially reduced by using heat storage of "off peak" power. The experimental work planned in connection with this problem has not yet been started. Although, for reasons already mentioned, the heat pump is usually regarded as being most suitable for temperate regions, special conditions may extend these limits.

Arctic Heat Pump

In the remote Arctic regions of Canada there are a number of small isolated settlements, mostly R.C.M.P. detachments, weather and radio stations, trading posts and missions. Transportation costs are extremely high, owing to the great distances involved and the difficulties and dangers of Arctic navigation. In some cases all supplies must be taken in by air. It was felt, therefore, that the use of a highly efficient heat pump might be justified on a direct economic basis and might offer additional advantages of an indirect nature. This proposal, which originated with Dr. A. D. Misener, was investigated at the University of Toronto under the auspices of the Defence Research Board of Canada.

The principal problem was, of course, that of a suitable heat

source. Air, at a design temperature of minus 50 deg. F., is uneconomically low in temperature, and therefore unsuitable as a source of heat. The ground, in the "permafrost" (permanently frozen sub-soil) regions of the Arctic, is also low in temperature and is, moreover, exceedingly difficult to excavate for ground coil installations. There are, however, innumerable lakes, both small and large, in that region and usually the stations are located beside them. These lakes seldom freeze to a depth of more than eight feet, thus a supply of water at about 32 deg. F. is assured. In some instances, the use of sea water is possible.

The extraction of heat from water at this temperature involves freezing to recover the latent heat of fusion. While this procedure presents some mechanical problems, it was felt that the difficulties were offset by the high heat yield (144 B.t.u./lb.) and the constant and relatively high temperature of the heat supply as compared with environmental temperatures.

A heat pump was designed and built to utilize this source of heat and to be as efficient as was practically possible. It was designed to meet the heating capacity requirements of a small station (130,000 B.t.u./hr.) and, in this particular installation, the heat was circulated through a water heating system operated at comparatively low temperatures.

A liquid cooled, two-cylinder Diesel engine rated at 15 hp. was selected as the prime mover. This is coupled through a centrifugal clutch to a refrigeration compressor using Freon 12 as the refrigerant. The latter provides refrigeration for a continuous ice-making machine, which is an adaptation of a commercial flake ice-maker. In this unit the water (at 32 deg. F.) is frozen on the surface of a slowly revolving drum and the ice is continuously removed by a rotating spiral cutter. A screw conveyer discharges this ice into a high-speed centrifugal blower, which pulverizes the chips and delivers the ice to the atmosphere in a sugar-fine form, which is readily dissipated by the wind.

The latent heat extracted is delivered by the compressor to the condenser cooling water. Alternatively, in suitable circumstances, air could be used. The heated fluid leaving the condenser is then passed through two heat exchangers, in which the waste heat of the engine coolant and that of the engine exhaust gases are recovered. The auxiliaries, including the ice-making drum, the pumps and the blower are driven by a V belt from the engine. A simplified flow diagram of the unit is shown in Fig. 3.

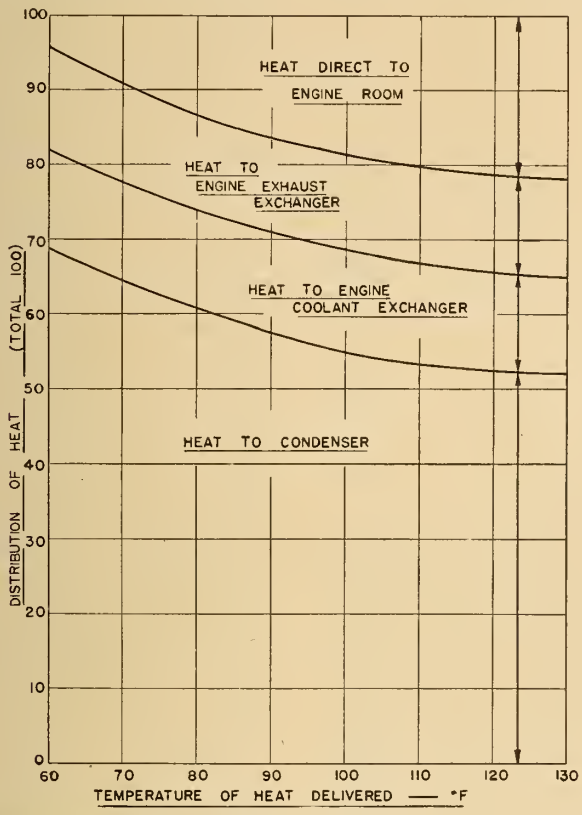

Fig. 5. Heat Balances for Arctic Heat Pump at Different Delivery Temperatures.

Although they were not actually installed, provision was also made in the design to include an electric generator and a water pump, so that the unit would be capable of fulfilling, not only the space heating requirements, but also the demands of a small station for hot and cold water and electricity. The entire apparatus was mounted on a single-skid frame 12 ft. 10 in. long, 4 ft. 9 in. wide, and 4 ft. 8 in. high (over-all weight 3½ tons) so that it is reasonably portable as a self-contained unit. Fig. 4 shows a general view of the installation.

Extensive tests have been carried out on the unit, both in the laboratory at the University of Toronto and during a winter's trial at a northern station, and the general thermal performance characteristics are given in Table 2. Sufficient space is not available to allow the complete data to be presented, nor to give in detail the basis of analysis of the tests. In general, it can be said that this heat pump delivers about 170 per cent of the higher heating value of the fuel supplied, which is approximately 2½ times as much heat as would be obtained from the same fuel in a conventional oil-burning heater.

The field tests have indicated several mechanical defects, notably in the ice disposition system, and a scaling problem has been encountered on the drum of the ice-maker. These difficulties have now been largely overcome, so that a production model could be built which would be both mechanically reliable and more compact than the present model. This type of unit has the advantage of low fire hazard and of the possible inclusion of an electric generator and water pump. The disadvantages are, respectively, its relatively large size and weight and the difficulty of maintenance in these remote regions.

Table II — Performance Characteristics from a Typical Test

Heating capacity (including heat to warm engine room)	125,960 Btu/hr
Fuel rate to Diesel engine	3.87 lb/hr
Ice produced	311.2 lb/hr
Over-all coefficient of performance based on higher heating value of fuel	1.71
Coefficient of performance of refrigerating machine	4.00
Cycle efficiency of refrigerating machine (Freon 12)	65.3%
Volumetric efficiency of refrigerating compressor	89.3%
Brake thermal efficiency of engine including connected auxiliaries	27.5%

Table III — Relative Prices and Performances Comparing Various Sources of Heat

Case A—Compressor cooling water to building air (Refrigerant F 12).
Case B—Mine water to mine air (Refrigerant F 12).
Case C—Compressor cooling water to wash water (Refrigerant NH_3).
Case D—Low pressure steam plant.
Coal cost—$15.00 per (short) ton. Electrical energy —$27.00 per HP per annum.

Heating capacity in Btu/min × 10^3	10	20	30
Relative installed costs—			
A	4.2	3.8	3.7
B	4.0	3.6	3.5
C	3.4	3.1	3.0
D	1.0	1.0	1.0
Coefficient of performance—			
A	4.7	5.25	5.35
B	4.3	4.65	4.7
C	5.0	5.55	5.75
Horsepower required—			
A	51	90	132
B	55	101	150
C	49	84	123
Running costs (relative)—			
A	0.87	0.72	0.67
B	1.04	0.84	0.81
C	0.57	0.46	0.43
D	1.0	1.0	1.0
Per cent return on additional investment—			
A	2.5	9.3	12.7
B	..	3.3	5.3
C	23.5	40.6	50.5

Neglecting these factors, it can be said that there are stations in Canada where such a unit would pay for itself in fuel savings in about one year, and in such locations the heat pump could be well worth while. It can easily be demonstrated that, at more southerly locations, other forms of heat source are more suitable. The diesel engine with waste heat recovery has, however, proved particularly efficient, and this method of driving any heat pump (used with a different heat source) would probably give the most economical results in any climate. A heat balance for this unit at various outlet (heating) temperatures is given in Fig. 5.

Application to Mining Areas

The gold mining areas of Northern Ontario were selected for study because they are remote from the main industrial areas, and have to be supplied with coal, mostly from the United States, at a present price of about $15 per (short) ton. Substantial reductions in fuel consumption would have obvious economic advantages. Accordingly eight representative mines were visited in 1949 by J. B. Templeton, B.A.Sc., with the object of determining the best heat sources and estimating possible economic results.

The most convenient heat source is the compressor cooling water, to which about 10,000 B.t.u. are rejected per 1,000 cu. ft. of air compressed. This quantity might be increased by using in the jackets water pumped from underground, but the latter contains impurities and suspended matter, and is seldom used for that purpose. Mine water, extracted from the upper levels, is relatively cool, but water from below 1,500 feet is a good source of heat if there is enough of it. Recirculation of this water could be used in suitable cases to extract heat from the underground rock, but the economic advantage of this procedure is rather uncertain.

Other possible sources of heat are "tailings" and solutions leaving the mill, but these are frequently corrosive and the life of any heat exchanger working under these conditions would be comparatively short. Nevertheless, in some cases non-corrosive wastes could be employed with advantage. Ventilating air carries away large quantities of heat, but its large volume and high moisture content, with consequent icing on the cooling coils, make its use uneconomical in most cases.

The duration of heat demand and the distance between the source of heat and its ultimate destination are important factors, particularly when, as with the compressor cooling water, the supply of heat is continuous. Ventilating air must be heated for about six months in the year and buildings for eight months, while the miners' change house and wash water provide continuous loads. These periods are assumed in the comparisons made in Table 3. It is also assumed that the wash water is heated to 125 deg. F. and in most instances the heat available from the compressor cooling water is sufficient for both of these purposes. The relative prices and performances in Table 3 are taken from the actual average costs in Northern Ontario in 1949. It has been assumed that Freon (F 12) must be used for safety where ventilating air is being heated, but that ammonia is to be preferred for heating wash water, on account of its higher coefficient of performance. Running costs and probable returns on investment have been based on amortization periods of ten years for steam and thirteen years for the heat pump.

Conclusions

From this study the following conclusions are drawn:

1. The use of one or more heat pumps, extracting heat from the compressor cooling water and heating the wash water and change house is definitely economical, if sufficient electrical energy is available at the price now prevailing. During periods of very low atmospheric temperature it will probably be advisable to use auxiliary steam heating to improve the load factor on the heat pump.
2. The heat pump may be used economically for heating (and cooling) other buildings, using the compressor cooling water as a heat source.
3. The use of heat from mine water or underground rock is only slightly more economical than steam, and then only in the larger sizes of heat pump.
4. The extraction of heat from mill tailings is only practicable in exceptional cases.
5. The absorption of heat from exhaust mine air is an attractive prospect, but needs further study to produce a workable scheme.

It is realized that the foregoing represents average conditions only, and that each mine and locality has its own problems which must be dealt with individually. Nevertheless, it is considered that this analysis gives a reasonably correct appraisal of the situation existing in 1949-1950.

Acknowledgments

The thanks of the authors are due to the Hydro-Electric Power Commission of Ontario and Mr. Bruce MacDonald; to the Defence Research Board of Canada; to Mr. J. B. Templeton, B.A.Sc., for providing certain material for the paper, and to Mr. M. J. Kenn, B.Sc., for assistance in making the drawings.

R.C.A.F. RESEARCH AND DEVELOPMENT

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

by

Dr. J. J. Green, M.E.I.C.

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The Royal Canadian Air Force came into being as a permanent Service in 1924, less than thirty years ago. Prior to this there had been a Canadian Air Force approved under the Aeronautics Act, 1920, but organized only on a temporary basis.

As early as 1919 the Honorary Advisory Council for Scientific and Industrial Research (now the National Research Council) was asked to create an Associate Air Research Committee to foster aeronautical research in Canada and to supply technical assistance in the solution of those problems which were expected to arise in the operation of aircraft in Canada. This marked the beginning of Canadian Government interest in organized aeronautical research, an activity which had developed rapidly during World War I, when the potentialities of air warfare first began to be exploited.

For the next ten years the Air Research Committee encouraged a number of university engineering research projects of interest to aviation. In particular, the Toronto University wind tunnel was kept busy testing models of aircraft being developed by Canadian industry for the Air Force. Good work was carried out at Alberta University on the problems of aero engines at low temperatures — problems which are still with us and likely to remain so.

Despite the excellent work done in the Universities, the Associate Air Research Committee was aware of the need for aeronautical laboratories which could operate on a continuous and permanent basis, and to which the R.C.A.F. could have direct access. This need was met in 1930 with the establishment of aeronautical laboratories under the National Research Council, and the fine record of accomplishment of these laboratories during the last twenty years, under Mr. J. H. Parkin's direction, has received international recognition.

For the first ten years of its life the Royal Canadian Air Force was occupied mainly with what were called Civil Government Air Operations. These included forestry patrol and service, aerial photographic survey, the establishment of bases in remote regions of the north, and transportation for Dominion services in these regions. This work tended to prevent the development of the R.C.A.F. as a balanced defence service, and the associated research and development problems were similar to those encountered in the evolution of civil aviation.

Air Research During War Years

With the outbreak of World War II in 1939, new and expanded aeronautical research facilities were under construction to augment or replace the obsolescent equipment of the laboratories. These were needed to keep pace with the expected rapid development of military aircraft. The wartime role of the R.C.A.F. in Canada was to be aircrew training, however. There were to be no important aircraft developments by Canadian industry, which was engaged fully in the manufacture of aircraft designed and developed in the U.K. or the U.S.A. As a result of this decision the engineering research laboratories were kept busy helping to keep the training aircraft flying. The task was unspectacular, but was an important requirement for the success of the Air Training Plan, and indeed of the war effort itself.

There was one significant step in the evolution of R.C.A.F. research and development which was taken during the War. Hitherto nearly all research and development had been concerned essentially with aircraft themselves and their engineering details. Now, for the first time, it became necessary to engage in other fields of study rendered important by the growing complexity and performance of the aircraft. The first of the new fields of study was aviation medicine. Nothing had been done before in Canada, yet the studies made in the U.K. and the U.S.A. showed that this subject was of the greatest importance.

Whatever the role of the R.C.A.F. in Canada, in Europe Canadian pilots and other crew members were faced with the same problems and hazards, introduced by the ever-increasing performance of military aircraft, as those encountered by the aircrews of our allies. The subject was developing rapidly and much work needed to be done. In 1939 there was no medical branch of the R.C.A.F. but due to the efforts of Major A. A. James of the R.C.A.M.C. and Sir Frederick Banting, the study of aviation medicine was commenced here. Shortly thereafter the R.C.A.F. created its own medical branch.

With support and leadership from the National Research Council and the universities, much good work was done by the Medical Officers of the R.C.A.F., and the doctors and physiologists in the universities. The development of oxygen supply systems, the study of decompression sickness, the protection against centrifugal force, motion sickness, cock-

Tracing the development of air research in Canada since the first university aviation research projects thirty years ago, the author outlines its scope during World War II and its vastly expanded post-war role, due mainly to the gas turbine and the growth of Canada's aircraft industry. Post-war features have included aerophysicist training and greater attention to aviation medicine.

Other research developments discussed include those concerning radar control, anti-aircraft defence, guided missiles and their aerodynamics, air navigation, and operational research.

pit lighting, night vision and protective clothing were the main subjects in which Canada made notable contributions.

Post-war Growth of Research

In post-war years a number of factors have arisen which have had a profound effect on research and development for the R.C.A.F. In the first place, the performance of military aircraft grew rapidly during the War and astonishingly so after the War, with the advent of the gas turbine. It is now possible for long-range bombing aircraft to reach any important area of Canada from a potential enemy country, and the primary role of the R.C.A.F. has now become the air defence of Canada. This has multiplied many times the fields of interest in which research and development for the R.C.A.F. is essential.

A second factor has been the creation of the Defence Research Board in 1947, with responsibility for research relating to the defence of Canada. It was felt, after the War, that it was advisable to separate the research effort devoted to defence from that accorded pure scientific and industrial research, and that defence research should be on a permanent footing. Whenever facilities are available the Defence Research Board seeks the co-operation of existing research agencies within Government Departments, universities and industry. It also operates a number of highly specialized research and development establishments of its own, devoted to the problems of the Armed Forces.

Still another factor which has influenced research and development for the R.C.A.F. is the growth of Canadian industry since 1939. The capacity for designing and manufacturing in Canada highly specialized and complex items of military equipment to rigorous standards has been demonstrated. This has awakened in us the realization that we can be self-reliant. This is particularly true of the aircraft industry. Never before has this industry attempted to design and develop anything so complex as a military aircraft or engine.

Yet since the War, encouraged and supported by the Government, we have seen how A. V. Roe Canada has produced a first-class jet fighter and one of the finest contemporary jet engines in the world. And make no mistake, a post-war fighter aircraft is many times more complex than those we fought the War with and a jet engine is more exacting in development than a piston engine. This growing industrial complex has, since the War, been called upon to design and produce equipment of all kinds for the R.C.A.F., as well as for the other Services. Research and development associated with this industrial production has inevitably increased in quantity and diversity.

Looking back on this post-war research and development, I think of it as beginning with the R.C.A.F. sponsoring the design and construction of the CF-100 fighter and the Orenda engine. This resulted immediately in a requirement for extensive research and experiment in the laboratories operated by the National Research Council. These are now an integral part of the National Aeronautical Establishment, which you may recall was organized with the approval of the Government a little more than one year ago. The design activity at A. V. Roe Canada had its major influence on the aerodynamic section, which was concerned with the wind-tunnel testing of a model of the CF-100, and on the structures laboratory, which had to undertake strength tests and investigations of actual structural components.

Canadian facilities alone were inadequate to meet the demand, and additional high-speed wind-tunnel tests were carried out in the United Kingdom and in the United States. Other research work which would have an impact on the new fighter was pressed forward energetically. As an example, means for protecting the engines and airframes against the deposition of ice during flight in adverse weather conditions had to be developed, based on the accumulation of sound fundamental knowledge. Mr. J. L. Orr presented the results of some of this de-icing research in a paper read at the last Annual Meeting of the Institute.

Training of Scientists and Engineers

After the Defence Research Board was created in 1947, it recognized that such ambitious projects as those undertaken by the A. V. Roe Company would place a heavy demand on the thin supply of suitably trained university graduates. One of its first acts therefore was to sponsor the establishment of an Institute of Aerophysics at Toronto University. It has also generously supported the Gas Dynamics Laboratory created at McGill University. Both of these experiments have proved to be highly successful. A steady stream of specialized, well-trained graduates has emerged from both places to fill the needs of industry, the Government research laboratories and the R.C.A.F.

At Toronto, under the able leadership of Dr. G. N. Patterson, a laboratory devoted to high-speed airflow has been built up to the point where it is gaining attention and recognition abroad. Dr. Patterson's research students have concentrated on the properties of the shock waves, which are characteristic of supersonic airflow. His students have made studies of the absorption and amplification of such waves by gaseous layers. Others have studied the refraction of shock waves, their collision and interaction. All this has been excellent in training and in the growth of our basic knowledge. For the design of high-speed aircraft for the R.C.A.F. such knowledge is important, and some day problems encountered in the operation of high-speed aircraft by the R.C.A.F. will depend on this knowledge for their solution. We are already in the era of the new aerodynamics where the growing emphasis is on supersonic operation, and where consideration of low-speed subsonic characteristics will be required mainly for the take-off and landing phases.

At McGill University, Dr. D. L. Mordell's contributions to training and basic knowledge have been first class. The laboratory, as any can see who visit it, shows an unexpected diversity of work within the gas dynamic field. Satisfying the special interests of the R.C.A.F. and the gas turbine industry, one can point to the emphasis given to combustion research and the performance of combustion chambers, to investigations dealing with carbon formation and to the growing interest in the problems of compressors. Men with gas dynamics training and some research experience are of interest to our engine manufacturers, to the National Aeronautical Establishment and to the A.M.T.S. Division of the R.C.A.F. We are relying on McGill University to satisfy this need.

Increased Importance of Medical Research

I must turn now to the many diverse fields of research and development which have become so important to the R.C.A.F. in the post-war period. It will be necessary in general to present the picture as a broad canvas, because time and the strict demands of security preclude a discussion in detail. Nevertheless I shall try to present some aspects of the work at greater length in the hope that you will be compensated for the more general treatment of other subjects.

Since aviation medicine was possibly the first of the new fields to receive attention, it makes a convenient starting point. Despite the good work done during the War, aviation medicine research in Canada almost petered out completely when the War ceased. Yet, in contrast, the performances of military aircraft increased more in the years after the War than they did during the War years. Speeds of flight, rates of climb and operating altitudes have all increased, some of them phenomenally, and in proportion thereto the problems of aviation medicine have also grown.

Some of the pressing problems are now being studied at the Defence Research Medical Laboratories, which were established at Toronto by D.R.B. during 1950, in close association with the R.C.A.F. Institute of Aviation Medicine. These laboratories study the physiological and occupational problems of man in a military environment. They are concerned with his suitability and training for his tasks, his equipment, his clothing, the hazards of his environment, the food he eats and the possible methods by which the effects of his human limitations can be minimized.

The importance of the human factor in warfare cannot be overemphasized. Stories from the Korean front tell of the excellent quality of the MIG.15 aircraft, but, despite this, the United Nations' pilots still manage to shoot them down at a much greater rate than our own losses, and it is reasonable to assume that the personnel factor is an important consideration. There are many instances where the improvement of military equipment can only be obtained for the expenditure of very great effort and cost, or at the expense of considerable additional power to operate it. Improvement in effectiveness might be obtained more easily, however, by a study of the human side of the man-machine combination.

One interesting example of progress concerns the studies of motion sickness undertaken at Toronto. Dr. Walter Johnson found that there is a close correlation between inadvertent movement of the head and susceptibility to motion sickness. People who tended to become sick are those whose heads tend to move relative to the rest of the body. Evidence is now forthcoming that restraining the head from making these inadvertent movements causes a significant decrease in the incidence of motion sickness.

Radar Screen

Just prior to the last War, radar was developed in the United Kingdom as a method for detecting the approach of hostile aircraft. I am sure that you are all familiar with the brilliant success of this invention in the Battle of Britain. Now that the R.C.A.F. is responsible for the air defence of Canada, radar has become one of its most important concerns. Extensive research and development is in hand to ensure that Canada will be provided with an effective radar screen.

One of the major problems is, of course, the range at which approaching aircraft can be detected. In any air defence system it is desirable to make this as great as possible, in order to alert the various elements of the air defence and civil defence systems without delay. In general, the ultimate range of any given radar set is limited by the curvature of the earth, and there are a number of technical difficulties to be faced in achieving the maximum possible range within this ultimate limit. Because of the characteristics of radar performance, it is possible to have early warning coverage in which approaching aircraft can be detected. But accurate information on height is not possible, except at considerable added complication and cost.

There is, then, a somewhat smaller area of cover in which accurate height data is obtainable, and in which it is possible to observe the defending fighters, and to control them through a suitable two-way communication system. This control of the fighters is exercised from a control centre, to which the information presented by the ground radars is transmitted, and at which all other relevant information necessary for the control of the fighter squadrons is displayed. This latter area, in which ground control of the fighters is possible, is referred to as the area of GCI (Ground Controlled Interception) and it is here that the defending squadrons are vectored to intercept the enemy.

It will be realized that one method of increasing radar coverage is to increase the number of radars, and to locate them in forward areas. Unfortunately modern radars are extremely expensive and there is an economic limit to this approach. Furthermore, in Canada, the forward areas are occupied by sparsely populated, somewhat inaccessible and undeveloped country, in which a modern radar set will pose a logistic problem in its installation, operation, supply and maintenance. The magnitude of the problem will be appreciated when it is pointed out that the total number of persons for the operation and support of such a radar station is of the order of four hundred.

It is obvious therefore that the disposition of radar cover is an important problem, to which considerable research attention must be paid. You will appreciate that a system of radar and airfield defences must involve some form of communication system linking them together, and including the control centres and the operational headquarters. Here again it has been necessary to expend research and development funds to ensure that an efficient, economic system will be provided.

Associated with this problem is another with somewhat broader implications. This concerns the methods adopted for the display of raid warning information, and the transmission of such data from place to place. Such problems involve the electronic engineer, the operational research man and the specialist in human engineering, working together with the R.C.A.F. personnel of Air Defence Command, on whom the burden of operating the system will fall should war come.

Anti-Aircraft Defence

The problem of shooting down a bomber is no easier today than it was in World War II. In fact, it has been made more difficult because of the speed and height range now available to a modern bomber. In World War I anti-aircraft guns were viewed with contempt by the pilots of that period. Even against the slow aircraft then used, and at the low altitudes of flight the guns were hardly effective. In World War II the addition of radar fire control, together with improvements in gun and ammunition design, increased considerably the effectiveness of anti-aircraft guns, despite the higher speeds and altitudes of the aircraft. The great increase in these performances since the War will pose an even tougher problem for the guns.

Meanwhile we are aware that the surface-to-air guided missile promises such great improvement in effectiveness over the gun that the pendulum may well swing over at last in favour of the defences. The whole subject of guided missiles has developed rapidly in the last few years due to the expenditure of much research and development effort. At the present time the Defence Research Board is engaged in the development of an air-to-air guided

missile for the R.C.A.F. Since the War, the great progress in aircraft development has not been matched by a similar record of improvement in aircraft armament.

In fact there has been no progress at all. Even during the War the armament of fighter aircraft was such that to approach to within effective range of the rear of a bomber or bomber formation was an invitation to sudden death, because of the heavy defensive fire that would most likely be encountered. The unguided aircraft rockets, each with a respectable charge of H.E. in its warhead, fired in salvos and from much greater range than would be possible for an aircraft gun or cannon are possibly an interim solution. However, it is generally conceded that for dealing with bombers the guided missile will be the most effective fighter armament.

Guided Missiles

The air-to-air missile for the R.C.A.F. is under development at the Canadian Armament Research and Development Establishment, one of the Defence Research Board's own laboratories. This establishment is assisted materially by the National Aeronautical Establishment, by the Defence Research Electronics Laboratory, the Radio and Electrical Engineering Division of the National Research Council and by Canadian industry. Security prevents me from giving you any details of this missile, but I can in a general way discuss briefly some of the possibilities and problems. Almost the first problem in considering a guided missile for a fighter aircraft is that of size, because this decides whether the missile can be stowed internally, or must be carried externally on a suitable launcher.

The method of stowage obviously has an influence on the air drag, and hence the flight performance to be obtained from the aircraft with its armament attached. The size of the missile is determined, not only by considerations of stowage, but is dependent also on the type of warhead and fuze and the system of guidance to be employed. If, for instance, the method of guidance and the missile manoeuvrability characteristics are such that the probability of a direct hit on the bomber is very high, then obviously one need only rely on quite a small warhead with an impact fuze, and the missile might be kept reasonably small. On the other hand, if one foresees the probability of near misses the tendency would be to use a larger warhead of the blast or fragmentation type with some sort of proximity fuze. In this case the missile would tend to be larger.

There are numerous ways in which the missile can be guided. One of the simplest is referred to as "command guidance" in which the missile is guided visually to the target. The operator is provided with manual controls, linked either by a fine wire or by radio with the missile itself. Through suitable control movements he directs the missile to the target, correcting any errors in flight by visual observation. In the beam riding system of guidance a radar beam is directed towards the target. In the missile there is a receiver which detects any departure of the missile from the axis of the beam. This error signal is then fed into the missile control system, so that appropriate movements of the aerodynamic control surfaces will cause it to fly back to and align itself with the axis of the beam.

In the semi-active homing systems of guidance a ra lar set in the fighter is used to illuminate the target aircraft. A receiver in the missile picks up reflected energy from the target. The guidance system then gives appropriate instructions to the control system, so that the missile turns and flies directly towards the target. In the fully-active homing system of guidance the transmitter which illuminates the target is also placed within the missile along with the receiver. This makes the missile completely self-contained, and allows the fighter aircraft to have complete tactical freedom after the missile has been launched. Finally, there are the passive homing systems which use some quality of the target itself, such as the heat generated by it, to actuate the guidance system of the missile. There are many problems associated with any guidance system development. As an example, I can quote the problem of discrimination. How can a missile be made to choose one of two or more targets, so that it flies accurately towards the selected one ?

Turning briefly to the question of propulsion, it will suffice to point out that there are several methods for propelling a missile, including solid propellant rockets, bi-fuel liquid rockets and monofuel ramjets.

Missile Aerodynamics and Control

The guided missile poses a number of aerodynamic problems. In the first place, the missile must be stable in flight, from the low speed of launch up to its highest speed of flight. This stability must be positive, both before and after the consumption of the propellant, which changes the centre of gravity thereby influencing the stability. To enable the missile to correct its course smartly and at high flight speed it must be highly manoeuvrable, and must be capable of sustaining large transverse accelerations imposed by the wing surfaces. This means that the wings must be as large as possible, which conflicts with the requirement that the missile be kept as small as possible. The ability to withstand high accelerations introduces structural problems for the wings, which for high-speed supersonic flight must also be kept very thin for aerodynamic reasons.

Since the missile is travelling at very high speed, any delay in the actuation of the control surfaces, in response to signals from the guidance system, would involve the covering of considerable distances before the missile responded. This would obviously reduce the accuracy of the missile, and could not be tolerated. Again, the heavy lift loads sustained by the wings of the missile can introduce large hinge moments if control of the missile is effected through wing deflection. It is obvious, therefore, from these considerations that control systems for guided missiles must be instantaneous in response, they must be precise and they must be very powerful.

It will be appreciated that a guided missile is an integrated device having all the characteristics of a dynamic system. The guidance unit produces the error signal, which in turn produces a response from the control system: this deflects the aerodynamic surfaces, causing a change in the flight path of the missile. Such a change should be heavily damped, enabling the missile to settle down quickly on the new and correct path. The dynamic response of guided missile systems can be studied at great length and with appropriate changes in the variables by means of electronic analogue computers.

It should not be thought that this preoccupation with guided missiles has put an end to all further work on the older, more conventional armament. This is not so, and the R.C.A.F. has several problems for research and development in the conventional gun and ammunition field. These are more or less day-to-day problems aimed at improvements in training and operations, or the development of specialized handling equipment or instruments for the observation of gun behaviour and gun kinematics.

Air Navigation

One very important subject in which Canada is making some novel contributions is concerned with special instruments for air navigation. During the last War Canada undertook the training of air navigators for the Commonwealth Plan, and the R.C.A.F. gained a wide reputation for the excellence of the navigator graduates. The continuing importance of air navigation to the R.C.A.F. is indicated by the fact that it operates a Central Navigation School at Summerside. Here specialist navigation courses are given to selected students who have already passed through basic and intermediate navigation training.

There are several reasons why the R.C.A.F. is still very much concerned with navigation. In the first place, the north magnetic pole lies within Canadian territory. This is an embarrassment rather than an advantage, because in the area surrounding the pole the magnetic compass is of little use, and reliance must be placed on other navigating instruments. Unfortunately the high speeds of flight and the necessity for precise navigation have extended this area to include almost the whole of the Canadian north. Again, the vast areas of Canadian territory over which the R.C.A.F. now operates, coupled with the absence of radio aids to navigation, makes it imperative that the quality of air navigation be excellent. The hazard to life in the event of aircraft getting lost and having to force land, particularly in the winter months, is well understood. There is always, of course, a desire to simplify the processes of navigation, as long as no sacrifice in precision is made. This applies particularly to the small high-speed aircraft in which the cramped quarters militate against the employment of those techniques that space will permit the navigator of a large aircraft to employ. Yet the high speed of flight increases the need for accuracy.

With these incentives the R.C.A.F. has, for a modest expenditure, initiated a number of developments which promise to go far towards the simplification of navigation procedures. Some of these developments will, I am sure, be of interest.

Most of you are bound to be aware of the time-honoured manner in which a navigator works. He has a reasonably sized chart on which he draws, as a straight line, his desired track. From time to time he estimates his position, plots it on the chart and proceeds to determine his corrected course. Unfortunately for the navigator military aircraft, particularly fighters, cannot be restrained to fly in straight lines. The requirements of their mission often entail a most complex course composed of a combination of curved paths and straight ones. Under such conditions a navigator is at a hopeless disadvantage in estimating position.

It became obvious that what was needed was an instrument that would keep track of the heading and speed, and which would integrate the mileage, resolving the total distance into northing and easting, in other words latitude and longitude. This is the basis of operation of the high-speed air position indicator. Heading is provided by the gyromagnetic compass, true air speed is given by a commercial meter and, by integration, air mileage is obtained. The heading and mileage are then fed into a computer which resolves the total mileage into changes in latitude and longitude. This instrument is suitable for aircraft speeds up to about 700 knots. Since wind has not been taken into account it is, of course, necessary to introduce a wind correction to get useful information in the form of true latitude and longitude.

In order to correct for wind a ground speed and interception computer (GSIC) has been developed, which automatically solves the vector triangle, two sides of which are defined by heading and air speed, wind direction and wind speed. The computer, which operates on the mechanical analogue principle, then determines the third side of the vector triangle — the ground track and ground speed. If now the ground speed is integrated to yield ground mileage and if this, together with the ground track, is fed into the air position indicator, instead of the heading and air mileage, the answer provided by the instrument will be the true latitude and longitude. The air position indicator has, in fact, now become a ground position indicator.

It will be appreciated that the accuracy of the final result will depend on the accuracy of the wind information fed into the ground speed and interception computer. This can be based either on forecast winds or on actual wind measurements provided by a meteorological station, or on wind determination by navigational procedures.

Pilot's Problems

In air navigation, particularly for small fighter aircraft, the pilot is used to working in polar co-ordinates. He measures his track as a radial distance out on a certain bearing from his take-off. Furthermore, in the air, he is interested in the direction in which he has to fly and the distance he has to cover to his destination, or to return to his base or to some other alternate base. Latitude and longitude data, while being acceptable to the navigator of a large aircraft, are not immediately useful to a pilot doing his own navigation. A polar co-ordinate computer, known for obvious reasons as the $r\theta$ dead reckoning computer, has therefore been developed. This computer merely takes the track and ground speed data from the ground speed and interception computer, and resolves it into bearing and mileage from the original base or from any desired alternate base. No matter how tortuous the path flown through the air, the correct bearing and distance is given at all times on the dial of the instrument. Again, the accuracy depends on the reliability of the wind information assumed.

Another interesting development for arctic flying concerns the effect of twilight. In the Arctic the unreliability of the magnetic compass results in a greater use by navigators of astronomical observations. Unfortunately, at twilight, celestial bodies are seldom visible. In the Arctic, due to the obliquity of the sun's apparent path, twilight can last much longer than at other latitudes. Not only that, but due to the reduced linear velocity in rotation of the earth's surface at high latitudes, aircraft speeds are such that they can easily keep up with or even overtake the sun in its apparent passage around the earth. This also can prolong twilight for the navigator, in fact on east-west flights it can be prolonged indefinitely. In planning a flight in the Arctic, in which twilight is to be avoided, the speed and direction of flight must be considered when calculating the duration of twilight. It is necessary also to compound these with the easterly rotation of the earth in order to determine the total motion of the aircraft relative to the sun, and hence to the twilight belt. To do all this easily a simple twilight computer has been developed. It was employed in the flight planning of the first R.C.A.F. flight to the North Pole in May, 1949, and has, since then, been in regular use on high latitude flights.

Operational Research

No report on research and development for the R.C.A.F. would

be complete without some reference to operational research. This is an activity which developed to maturity during the last War, and which met with very impressive success in its wartime applications. It was, for instance, the methods of operational research analysis that enabled the radars to be sited in the U.K. in such a manner that their effectiveness in the Battle of Britain was maximized.

Here in Canada the R.C.A.F. initiated operational research during the last War on a somewhat modest scale. The Defence Research Board now has an Operational Research Group which is accorded the status of one of our establishments. There are also operational research sections attached to the three Services and, working closely under their direction, the scientists on the staffs of these sections being provided from the Defence Scientific Service. Additional sections are attached to Air Defence Command, the Joint Maritime Warfare School and Western Command.

The Operational Research Group itself is mainly concerned with studies which are quite broad in scope, but which are of vital interest to the Services. The particular responsibilities of the R.C.A.F. have meant that ORG has been preoccupied with air defence problems to a considerable degree. Using the methods developed so successfully during the War, together with some new ones, it has for instance been able to make some contributions concerning the disposition of the various elements of our defence system. Other studies in which there is an immediate and obvious interest concern the relative aspects of various air defence systems involving guns, surface-air guided missiles or interceptors, separately or in combination.

In general, the operational research sections are concerned with day-to-day queries and problems of more limited scope. The function of the sections is to increase the efficiency of operations generally. In order to measure this it is necessary for them to devise exercises, from which can be derived critical information pertaining to the performance and capabilities of the defence system. Not all studies are connected directly with defence itself. A case which illustrates the value of operational research methods to general efficiency is the study now going on of the design, layout, dimensions and working arrangements of the navigator's compartment in large aircraft.

Since training of air and ground crews is always of the utmost importance, the operational research people have been asked to take a critical look at crew-training aids and to evaluate them. Still another example of the personnel problems which can be handled by operational research methods is the study of crew fatigue on long-range maritime reconnaissance flights.

During the last War operational research scientists began to give some thought to the various ways in which it was possible to conduct searches. Such studies were important in hunting down submarines reported as being in some general area, or in the search for and rescue of survivors from aircraft or surface vessels. Since the War these studies have been continued, and Canadian scientists have made some contributions. The results are of immediate value in the search for lost aircraft. The International Civil Aviation Organization is proposing to publish the work done in this field by Dr. John Stanley, in order that its usefulness can be extended to other countries.

In addition to the subjects of Air Force research and development on which I have touched lightly, there are a number of equally important fields of endeavour in which a considerable volume of research and development effort is being expended. There is, for example, the subject of photography for aerial survey and reconnaissance, covering the development of special cameras and photographic processing equipment. Again, the Defence Research Board has an active program of research and development concerned with atomic, biological and chemical (A,B,C) warfare. This work is undertaken as much in the interests of the R.C.A.F. as it is for the Canadian Army, since in any future hostilities the possibility that these methods of attack might be employed against us is of major concern to all Services. Similar arguments hold for the research and development effort in the field of radio propagation. Here again both Army and Air Force have significant interests. It is regretted that time does not permit an excursion into such fields of interest. I must be content with the few samples I have chosen to illustrate the kind of problems with which research and development for the R.C.A.F. are concerned. √

CANADIAN PETROCHEMICAL DEVELOPMENTS

(*Continued from page 609*)

some relation to the sales value of make-up fuel. This will work out in Montreal to about 60c per million B.t.u. The refiner in Alberta, however, will be able to make up his loss of fuel by the purchase of natural gas selling at approximately 10½c per million B.t.u.

Chemicals from Alberta are now classified as fifth-class freight. If they should be allowed a seventh class freight classification to Eastern Canada their rate will be 2.26c per lb. Rough calculations made on such commodities as ethyl alcohol and ethylene glycol and equating freight vs. fuel values show that this freight rate is sufficient to more than offset the advantage of a western producer selling in the east over an eastern producer. The margin is small enough, however, to make questionable any hard and fast conclusions one way or the other. The question of an eastern vs. a western location is approaching the realm of the academic, as the gas output of the eastern refineries is nearly all sold, and soon all new Canadian petrochemical industries will be forced to locate in the west. It then becomes a question of chemicals from petroleum in the West, versus coal, forest products or chemurgic products in the east, with heavy and still increasing freight charges a serious deterrent to western petrochemicals.

Freight is an important consideration for a low-priced commodity such as ethyl alcohol, but becomes less important for higher priced commodities. The principal products of the Canadian Chemical Co. are cellulose acetate flake, fiber, and yarn, which can better stand freight charges than cellulose, acetic anhydride, and acetone. A good proportion of its formaldehyde, too, is to be converted to pentaerythritol which is in the same category as regards freight. Polyethylene from the Canadian Industries plant in Edmonton is also a sufficiently high-priced material to absorb a heavy freight charge.

This upgrading of end products is the salvation of the petrochemical industry in the West. Also there is pressure being applied at Washington for tariff concessions which would permit the logical flow of petroleum products and petrochemicals from the western provinces into the United States northwest, in return for the flow of petroleum and manufactured goods from the eastern United States into Canada. √

Sixty-sixth Annual General Meeting

Convened at Headquarters, Montreal, on January 31st, 1952, and adjourned to the Hotel Vancouver, Vancouver, B.C., May 7th, 1952

The Business Meeting

The Sixty-sixth Annual General Meeting of The Engineering Institute of Canada was convened at Headquarters on Thursday, January 31st, 1952, at eight o'clock p.m., with Vice-President J. B. Stirling in the chair.

The general secretary having read the notice convening the meeting, the minutes of the Sixty-fifth Annual General Meeting, as published on pages 554 to 558 on the June 1951 *Journal*, were taken as read and approved.

Appointment of Scrutineers

On the motion of H. G. Cochrane, seconded by C. G. Kingsmill, Messrs. J. P. Carriere, E. G. Fraser and J. P. Dagenais were appointed scrutineers to canvass the officers' ballot and report the result.

There being no other formal business, on the motion of R. H. Findlay, seconded by J. A. McCrory, it was resolved that the meeting do adjourn to reconvene at the Hotel Vancouver, Vancouver, on Wednesday, May 7th, 1952.

The adjourned meeting convened at nine thirty p.m. on May 7th, 1952, with President Ira P. Macnab in the chair.

Retiring President's Address

The text of the address of the retiring president, Ira P. Macnab, will appear in the July issue of the *Journal*.

Nominating Committee—1952

The general secretary announced the membership of the Nominating Committee of the Institute for the year 1952, as follows:

Chairman: C. E. Garnett, Edmonton, Alta.

Branch	*Representative*
Newfoundland	B. A. Monkman
P.E.I.	D. I. D. Rozman
Halifax	E. C. O'Leary
Cape Breton	H. J. McCann, Jr.
Moncton	H. J. Williamson
Fredericton	M. W. Black
Saint John	W. R. Godfrey
Saguenay	W. P. C. Leboutillier
Lower St. Lawrence	L. G. McLaren
Quebec	C. H. Boisvert
St. Maurice Valley	F. W. Bradshaw
Eastern Townships	J. C. Critchley
Montreal	J. M. Crawford
Cornwall	P. H. Nasmyth
Ottawa	J. L. Shearer
Kingston	J. W. Brooks
Belleville	A. D. Janitsch
Peterborough	A. L. Killaly
Toronto	W. E. Bonn
Hamilton	W. A. T. Gilmour
Kitchener	M. A. Montgomery
Niagara Falls	C. G. Cline
London	G. N. Scroggie
Border Cities	J. M. Wyllie
Sarnia	D. H. Welsh
Sault Ste. Marie	R. A. Campbell
Sudbury	P. R. McAdam
Lakehead	O. J. Koreen
Winnipeg	J. C. Trueman
Saskatchewan	G. W. Parkinson
Lethbridge	A. L. H. Somerville
Edmonton	J. W. Porteous
Calgary	D. A. Hanson
Central B.C.	F. McCallum
Kootenay	A. C. Ridgers
Vancouver	J. E. Macdonald
Vancouver Island	H. D. Dawson

Honorary Memberships

The general secretary reported that the following had been elected to honorary membership in the Institute and that certificates would be presented at the annual banquet or on some appropriate later occasion:

John Andrew Allan, B.A., M.Sc., PH.D., formerly professor of geology, University of Alberta, Edmonton.

Ernest Albert Cleveland, LL.D., chief commissioner, Greater Vancouver Water and District and

President Stirling receiving his gavel of office from the retiring president, Dr. Ira P. Macnab, Dr. N. R. Crump, senior vice-president, Canadian Pacific Railway, on left.

Typical Annual Meeting Groups (on the facing page)

Top. Members in attendance at meeting of new Council, Friday, May 9th.

Front row: J. F. Wickenden (Three Rivers), M. McLaren (Montreal), J. N. Finlayson (Vancouver), I. P. Macnab (Halifax), J. B. Stirling (Montreal), James A. Vance (Woodstock), E. A. Flynn (Halifax), G. E. Griffiths (Thorold), Sidney Hogg (Vancouver).

Middle row: A. S. Rutherford (Montreal), L. L. O'Sullivan (Montreal), F. L. Lawton (Montreal), I. R. Tait (Montreal), S. Sillitoe (Belleville), S. H. deJong (Vancouver), T. W. Lazenby (Trail), Milton Eaton (Shawinigan Falls), M. A. Montgomery (Kitchener), M. L. Wade (Kamloops), R. L. Weldon (Montreal).

Back row: W. E. Brown (Hamilton), L. G. McLaren (Rimouski), J. W. Graeb (Sarnia), W. C. Watt (Toronto), L. Austin Wright (Montreal), S. L. Baird (Trail), B. F. Willson (Edmonton), Huet Massue (Montreal), R. Bowering (Victoria), H. R. Hatfield (Penticton), E. J. Durnin (Regina), Allan Tubby (Regina), A. S. G. Musgrave (Victoria), H. G. Thompson (Montreal), E. L. Hartley (Vancouver).

Centre. Student Conference in progress, Tuesday, May 6th.

A. S. Gentles (Vancouver), Lieut.-Col. Alex. McTavish (Chilliwack), I. P. Macnab (Halifax), R. F. Shaw (Ottawa) Chairman, D. C. MacCallum (Montreal), A. Majid Ibrahim (Alberta) Secretary, and the following student delegates—Allan Hicks (British Columbia), K. R. Fowler (Saskatchewan), Norman A. Hanks (Manitoba), W. J. Cooper (Toronto), G. W. Crook (Queen's), Cameron Kenney (McGill), Pierre Brosseau (Ecole), P. E. Begin (Laval), David M. Baker (Nova Scotia Technical College), James Q. Calkin (New Brunswick), and observer P. S. Chisholm (Royal Military College).

Bottom. Ladies enjoying morning coffee.

chairman, Vancouver and Districts Joint Sewerage and Drainage Boards.

Francis William Whitney Doane, consulting engineer and formerly City Engineer, City of Halifax.

John George Gale Kerry, B.A.Sc., M.ENG., consulting engineer, Port Hope, Ont.

Awards of Medals and Prizes

The general secretary announced the various awards of the Institute as follows stating that the formal presentation of these would be made at the annual banquet of the Institute on May 9th:

Julian C. Smith Medals—"For achievement in the development of Canada", to Frederick Victor Seibert, B.A.Sc., M.E.I.C., consulting engineer, Edmonton, and Richard Laurence Weldon, B.Sc., M.Sc., M.E.I.C., president and managing director, Bathurst Power and Paper Company, Montreal, Que.

Gzowski Medal—"For the best paper of the medal year", to F. M. Wood, M.E.I.C., Kingston, Ont., for his paper "Graphical Solutions of Partial Differential Equations with Engineering Applications".

Duggan Medal and Prize—"For papers dealing with the use of metals for structural or mechanical purposes", to D. G. Elliot, M.E.I.C., Montreal, Que., for his paper "Recent Canadian Developments in the Cold Riveting of Aluminum" (written jointly with Ernest Anders).

Leonard Medal—"For papers on mining subjects", to Dr. George S. Hume, O.B.E., Ottawa, Ont., for his paper "Utilization of Natural Gas".

Plummer Medal—"For papers on chemical and metallurgical subjects", to R. H. Hall, Shawinigan Falls, Que., for his paper "Rotary Lime Kiln Operation".

Keefer Medal—"For papers on civil engineering subjects", to T. A. Monti, M.E.I.C., Montreal, Que., for his paper "Economy in Rigid Frames".

Ross Medal—"For papers on electrical engineering subjects," to P. L. Mathewson, M.E.I.C., Pointe Claire, Que., for his paper "Application of Diesel Electric Locomotives".

Prizes to Students and Juniors—"For the best papers presented by Students or Juniors of the Institute in the vice-presidential zones":

H. N. Ruttan Prize (Western Provinces), to John Henry, S.E.I.C.,

Top left. Professor F. K. Shallenberger addressing the luncheon on Friday, May 9th, on the subject, "The Push Button Factory".

Top right. T. Ingledow, Vancouver, chairman, Annual Meeting Committee.

Lower left. R. G. Johnson, president, Defence Construction Limited, speaking on" The Defence Construction Program" before the luncheon meeting on Wednesday, May 7th.

Lower right. Dr. N. R. Crump, senior vice-president, Canadian Pacific Railway Company, spoke on "Modern Pioneers" before the Annual Banquet on the evening of Friday, May 9th.

Members and guests at the Annual Banquet in the Ball Room of The Hotel Vancouver, showing Head Table guests at left.

Kingston, Ont., for his paper "Foundry Work".

John Galbraith Prize (Province of Ontario), to William A. Connelly, Jr.E.I.C., Montreal, Que., for his paper "Spot Welding".

Phelps Johnson Prize (Province of Quebec—English) to Ronald E. Dyson, S.E.I.C., Montreal, Que., for his paper "Fitting a New Steam Drum to a Marine Boiler".

Ernest Marceau Prize (Province of Quebec—French) (two awards), to R. Noël, S.E.I.C., Ottawa, Ont., for his paper "Contrôle electronique des chalumeaux oxy-acetyléniques dans le découpage des plaques métalliques"; and to Gilles Lefebvre,

Members and their wives enjoying supper on the boat trip around Vancouver Harbour: left to right—E. R. Smallhorn, Mrs. E. R. Smallhorn, F. O. McMillan, president, American Institute of Electrical Engineers, president of Oregon State College, Corvallis, Oreg., Miss J. Coupal, F. L. Lawton.

Past President Vance and Mrs. Vance at supper with members and their wives while touring Vancouver Harbour on SS "Lady Cynthia". Left to right: B. B. Hillary, J. A. Vance, Mrs. B. B. Hillary, Mrs. J. A. Vance, Mrs. H. Lillie, Mrs. S. Johnson, Mr. S. Johnson.

Another view taken at the Annual Banquet in the Ball Room of The Hotel Vancouver, Friday, May 9th.

S.E.I.C., Montreal, Que., for his paper "Installation d'une unité de déminéralisation de l'eau d'alimentation d'une bouilloire".

Martin Murphy Prize (Maritime Provinces), to James Q. Calkin, S.E.I.C., Woodstock, N.B., for his paper "Trenche Development".

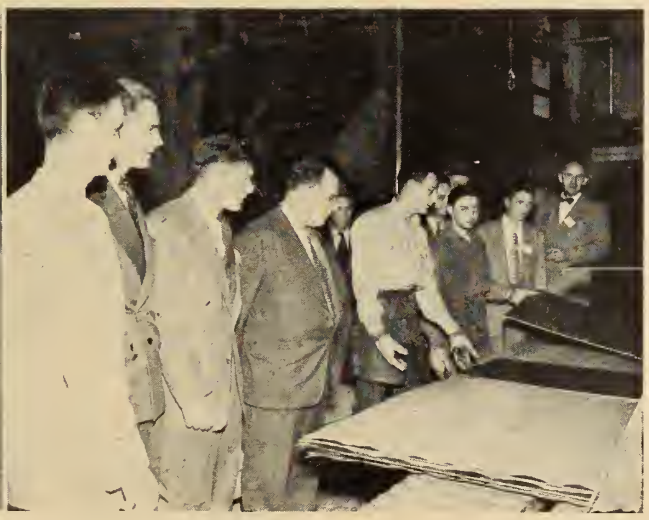
Report of Council, Report of Finance Committee, Financial Statement and Treasurer's Report

On the motion of J. A. McCrory, seconded by A. B. McEwen, it was resolved that the report of Council, the report of the Finance Committee the Financial Statement and the Treasurer's Report be accepted and approved.

Reports of Committees

In presenting the reports of the various committees the president emphasized the importance of the work done by these committees. He asked that it be recorded in the

E. A. Cross, W. Thornber, C. F. Morrison, F. W. Guernsey, L. R. Andrews (left to right).



Visit to a plywood plant on Thursday afternoon, May 8th. At left, E. W. Wellwood, G. C. Drake, F. L. Savage, F. Rousseau, P. M. Sauder; far right, A. Grindley and C. D. Carruthers.

minutes that he and the Council appreciated the excellent work done by this large group of members. It was very material to the success of the Institute.

On the motion of A. C. M. Davy, seconded by A. S. Rutherford, it was resolved that the reports of the following committees be taken as read and accepted: Legislation, Employment Conditions, Employment Service, Publication, Membership, Board of Examiners, Professional Interests, Library and House, Papers, Admissions, Prairie Water Problems, Canadian Chamber of Commerce, Canadian Standards Association.

Branch Reports

On the motion of Sidney Hogg, seconded by R. F. Legget, it was resolved that the reports of the various branches be taken as read and approved.

Amendment to the By-laws

At the president's request, the general secretary read the present and the proposed new wording of the first sentence of Section 55 of the by-laws as follows:

Section 55—The first sentence now reads—

"The Council shall meet at least once each month, from the

Speakers and Chairmen at Technical Sessions

Upper left. G. V. Eckenfelder, Montreal Engineering Co. Ltd., who spoke on the Spray Hydro Electric Power Development, with his chairman, J. A. McCrory, chairman of the board, Shawinigan Engineering Company Ltd.

Top right. Dr. J. J. Green, Defence Research Board (left), who told about "R.C.A.F. Research and Development", discussing the paper with the chairman, W. L. Inglis, airport manager, Vancouver International Airport.

Centre right. S. Lorne Fear, liaison engineer, The Hydro Electric Power Commission of Ontario (left) addressed a capacity audience on "Large Steam Electric Stations of the Ontario Hydro". A. C. R. Yuill, consulting engineer, Vancouver, was the chairman.

Bottom left. W. G. Small of Consolidated Mining and Smelting Co. of Canada Ltd., Trail, B.C. (left) who presented the paper on "The Organization and Functions of an Instrument Department" with his chairman, Leo Roy of the Quebec Hydro, Montreal.

Bottom left. E. M. Rensaa, Main, Rensaa and Minsos, consulting engineers, Edmonton (centre) discussing "Precast Reinforced Concrete Frames" with Dean R. M. Hardy, University of Alberta, chairman (left), and Dr. J. N. Finlayson, Vancouver.

Photographs of other speakers and their chairmen will appear in later issues as the papers are published.

The new president with three of his predecessors (left to right) J. A. Vance, I. P. Macnab, J. B. Stirling, J. N. Finlayson.

beginning of October to the end of April, and at such other times as may be deemed necessary".

The proposed new wording is—

"Council shall meet at least once every two months from October to May. Additional meetings that may be necessary to conduct properly the business of the Institute shall be held at the call of the president".

This proposed change has been approved by Council and in accordance with the by-laws, submitted to the corporate members in the December 1951 issue of the *Journal*. It was now necessary to have the proposed change authorized at the annual meeting so that it might go forward to the membership in ballot form.

The president called for a motion, and it was moved by J. P. Mackenzie, and seconded by A. E. Flynn, that the proposal to amend Section 55 of the by-laws be approved by this meeting and sent out to ballot. There was no discussion and on being put to the meeting the motion was approved without any dissenting votes.

Election of Officers

The general secretary read the report of the scrutineers appointed to canvass the officers' ballot for the year 1950 as follows:

President:

J. B. Stirling, Montreal, Quebec.

Vice-Presidents:

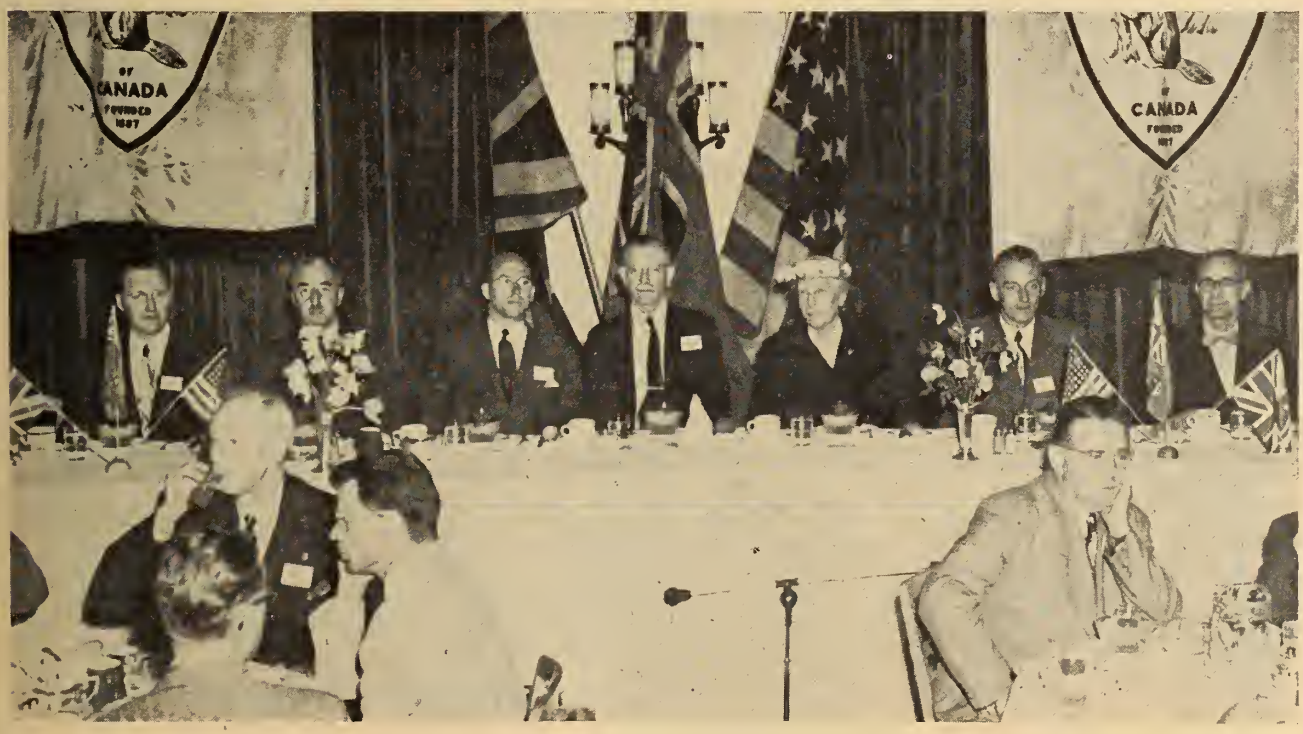
Province of Ontario—A. E. Berry, Toronto, Ont.

Province of Quebec—G. T. Malby, Isle Maligne, Que.

Maritime Provinces—D. J. MacNeil, Antigonish, N.S.

Councillors:

Vancouver Branch—Sidney Hogg.
Calgary Branch—J. J. Hanna
Lethbridge Branch—P. E. Kirkpatrick
Winnipeg Branch—T. E. Storey
Sault Ste. Marie Branch—D. C. Holgate
Sarnia Branch—E. W. Dill
Niagara Peninsula Branch—Paul E. Buss
Toronto Branch—C. D. Carruthers
Hamilton Branch—Neil Metcalf
Kitchener Branch—M. A. Montgomery
Peterborough Branch—A. E. T. Hailey
Ottawa Branch—B. G. Ballard
Cornwall Branch—Donald Ross-Ross
Montreal Branch—A. D. Ross, E. R. Smallhorn
Quebec Branch—J. M. Hector Cimon
Moncton Branch—Norman B. Eagles
Halifax Branch—W. H. Chisholm
Cape Breton Branch—C. N. Murray



Head table guests at the Friday luncheon (left to right) R. H. Elfstrom, A. B. McEwen, Prof. F. K. Shallenberger, guest speaker; I. R. Tait, Chairman; Dr. Lilian Gilbreth, J. B. Biker, A. Francis.

On the motion of R. C. Flitton, seconded by S. H. deJong, it was unanimously resolved that the report of the scrutineers be adopted, that the scrutineers be thanked for their services in preparing the report, and that the ballot papers be destroyed.

Vote of Thanks to Vancouver Branch

On the motion of I. R. Tait, seconded by E. P. Muntz, it was unanimously resolved that a hearty vote of thanks be extended to the members and officers of the Vancouver Branch in recognition of their hospitality and activity in connection with the sixty-sixth annual general meeting.

Vote of Thanks to Retiring Officers

On the motion of James A. Vance, seconded by E. R. Smallhorn, it was unanimously resolved that a hearty vote of thanks be extended to the retiring president, the vice-presidents and councillors in appreciation of the work they have done for the Institute during the past year.

On behalf of the officers and members of Council, the president acknowledged the vote of thanks and assured the members that what had been done would not have been possible without the support of everybody in every branch which had been visited. He expressed his own personal thanks and assured the meeting it had all been a great pleasure to him.

The meeting adjourned at ten fifteen p.m.

J. G. G. Kerry receiving his certificate of Honorary Membership from President I. P. Macnab at the Annual Banquet.

The Professional Meeting

Another annual meeting takes its place in the rich background of Institute history. The 66th meeting held at Vancouver in May seems to have maintained the high standards and in the minds of many, even raised them somewhat.

The meeting was a success from every point of view—there can be no doubt about that. Beautiful Vancouver offered its best weather, and there is nothing one can say beyond that. The Hotel Vancouver is one of the best in Canada for such meetings. The technical program was perhaps the best in years. This combination of the city, the weather, the hotel, the program plus the hospitality of the Vancouver people may indeed have set an all time high.

Registration was almost 750 including the names of approximately 500 members. This is almost as good as for meetings in Ontario and Quebec — indeed a remarkable achievement for a location so far from the centre of population. This is but further indication that the development of the western provinces is steadily moving the centre of gravity of population and development towards the West.

The jaunt to Victoria was an excellent affair. Over a hundred went by boat Saturday morning and attended the dinner held in the Crystal Gardens with A. S. G. Musgrave, presiding. Like Vancouver, Victoria presented some of its best weather, so the visits to the many lovely gardens and the motor trip to Nanaimo were conducted under ideal conditions. The Island never looked better. The whole project was a bright idea, conceived by the Vancouver Island Branch, excellently planned and greatly appreciated by the visitors. It was the finishing touch to a memorable occasion.

With a meeting so far from Headquarters it was to be expected that a greater share of the work of preparation and the conduct of the meeting itself would fall on the members of the local committee. This responsibility was accepted

President Macnab presenting Honorary Membership certificate awarded to the late Dr. E. A. Cleveland, to his son, Dr. C. E. Cleveland, M.E.I.C.

readily and carried out with great success, much to the pleasure and delight of the visitors. Every detail was attended to, including the personal wishes of individual visitors who had special interests not included in the official program.

The thanks of the officers, members and guests goes out in full measure to the chairman and members of the committee and the subcommittees. Here are their names.

Chairman—T. Ingledow.
Vice-Chairman—J. P. Mackenzie
Secretary—H. T. Libby
Treasurer—C. A. Manson
Registration—C. A. Manson
Entertainment—R. E. Wilkins, J. A. Webster, R. Walkem
Meeting Arrangements—J. E. Macdonald, P. Bland
"Muriel's Room"—E. Hartley, S. Hogg, R. H. Hobner.
Plant Visits—H. N. Macpherson, W. L. Inglis
Technical Papers—L. B. Stacey, J. C. Oliver, W. O. Richmond
Publicity—J. B. Carswell, T. V. Berry, J. S. Ball
Transportation—G. M. Letson, R. Pybus
Ladies (Engineers' Wives Association) —Mrs. George W. Allan

The Technical Program

It was of interest to note that out of 23 technical papers, 16 were related to developments in the West or were given by authors located there. While it is always planned to play up subjects related to the area where the meeting is held it is doubtful if the objective has been so well met in the past. The West is so full of new and proposed projects these days that it is not too difficult to build a program around them.

Technical sessions have never been attended better. In the majority of meetings the rooms were too small. It is seldom that 300 people gather for a technical paper, but a room with that seating capacity was over-crowded frequently with as many as 50 standing on more than one occasion.

It is likely that all papers will be approved by the Publications Committee for printing in *The Engineering Journal*. In this way their usefulness will be multiplied many times. Publishers of other periodicals have already asked for and been granted permission to reproduce many of them.

Speakers

There were four occasions upon which audiences were addressed on appropriate but non-technical subjects. These were the luncheons and dinners. It is planned to publish all these addresses and therefore no comment is made on them in this report.

At noon, Wednesday, May 7th, R. G. Johnson, president of Defence Construction Limited and manager of the Canadian Construction Association spoke on "The Defense Construction Program". That evening the retiring president of the Institute, Dr. Ira P. Macnab delivered his presidential address. This he called "Canada, My Home".

At noon on Friday, May 9th, Professor Frank K. Shallenberger's address "The Push Button Factory" was an intriguing and thought provoking talk. That evening the main event of the whole program was the address of Dr. N. R. Crump, senior vice-president of the Canadian Pacific Railway Company. Together these four addresses were a worth while program in themselves. *Journal* readers may look forward with much anticipation to seeing them in print shortly.

Extra Curricula

The Vancouver Committee's arrangements for events outside the technical program were excellent. The plant visits on Thursday afternoon were unusually interesting, and the boat trip that evening was a feature event, greatly enjoyed in spite of the "liquid sunshine" that went along with it.

The Engineers' Wives Association did a remarkable job as the ladies committee. They had their own ladies events program and as well were on hand at all times at

Top. Presentation of Julian C. Smith Medal to F. V. Seibert, consulting engineer of Edmonton by Dr. Macnab.

Bottom. R. L. Weldon of Montreal receiving his Julian C. Smith Medal from President Macnab at the Annual Banquet on Friday, May 9th.

"Coffee Centre" to take care of any special requests the visitors might have. Their interests in the needs of the visitors was greatly appreciated. As an aside, it might be noted that the E.W.A. at Vancouver proved again, as has been done at other centres, that the ladies through their own association are a powerful influence in Institute activities.

The Banquet

Always the main event of an annual meeting program, the banquet this year maintained its traditional place. Just under 600 people attended which itself would make any occasion a success. However, there were other features too. The presentation of medals and prizes was unusual in that all winners with the exception of one were present. It isn't often that in a country the size of Canada that can be arranged.

Mr. Crump spoke on "Modern Pioneers" and tied in the achievements of engineers and the importance of transportation to the development of Canada. The induction of the new president, Dr. John Bertram Stirling was the concluding item on the program.

It was a matter of concern to the Institute officers that the banquet

The Annual Banquet

Top left to right, on this and facing page: F. M. Wood, M.E.I.C., Kingston, Ont., receiving the Gzowski Medal; award of the Ross Medal to P. L. Mathewson, M.E.I.C., Pointe Claire, Que.; Plummer Medal being presented to R. H. Hall, Shawinigan Falls, Que. Second row, left to right: Dr. G. S. Hume of Ottawa, accepting the award of the Leonard Medal; D. G. Elliot, M.E.I.C., receives the Duggan Medal and Prize; Presentation of the Martin Murphy Prize to James Q. Calkin, S.E.I.C., Woodstock, N.B.; Award of the Phelps Johnson Prize to Ronald E. Dyson, S.E.I.C.

Head table guests at the Annual Banquet. Below, on this and facing page, left to right, seated: Dr. J. B. Stirling, president of the Engineering Institute; C. L. Fisher, president of the Association of Professional Engineers of Manitoba; Mrs. S. H. deJong; R. A. McLachlan, representing the president of the Dominion Council of Professional Engineers; Gerald S. Ortner, representing the president of the Chemical Institute of Canada; Mrs. P. M. Thornton; H. H. Moor, president of the Association of Professional Engineers of Alberta; Colonel C. R. Boehm, representing the Canadian Army; Mrs. R. C. Gordon; Dr. H. A. L. Mooney, president of B.C. Medical Association; Dr. F. W. Gray, representing the president of the Mining Society of Nova Scotia; Mrs. F. J. Hume; Professor F. O. McMillan, president of the American Institute of Electrical Engineers; Mrs. Ira P. Macnah; Dr. N. R. Crump, the guest speaker; Dr. Ira P. Macnah, retiring president of the Institute; His Worship F. J. Hume, Mayor of Vancouver; Professor Brian T. McMinn, representing the president of the American Society of Mechanical Engineers; Mrs. J. B. Stirling; Brigadier-General J. A. Clark, president of the Canadian Bar Association; Mrs. R. A. McLachlan; Commodore A. C. M. Davy, representative of the Canadian Navy; Mrs. H. A. L. Mooney; Peter M. Thornton, president of the Architectural Institute of British Columbia, representing the president of the Royal Architectural Institute of Canada; Mrs. B. T. McMinn; L. B. Stacey, president of the Association of Professional Engineers of British Columbia; Dr. J. S. Walton, representing the president of the American Institute of Chemical Engineers; Mrs. H. H. Moor; Air Commodore R. C. Gordon, representative of the R.C.A.F.; Dr. P. L. Pratley, representing the chairman of the Canadian Standards Association; Mrs. Gerald S. Ortner; S. H. deJong, chairman of the Vancouver Branch of the Engineering Institute.

Dr. J. A. Kidd and Mrs. J. A. Clark were at the head table, but unfortunately the photographs did not include either. Dr. Kidd is the president of the Canadian Institute of Mining and Metallurgy. Mrs. Clark is the wife of Brig.-General Clark, president of the Canadian Bar Association.

did not conclude until well after the scheduled time. A number of things combined to bring this about, hardly any of them being controllable. This note is included in the account simply as an indication to those who were present, that every effort will be made to foresee and circumvent similar occurrences in the future. A close adherence to the schedule is standard practice for Institute annual meetings—and will continue to be so in the future in spite of the occasional reverse.

The Reception

This year the reception of the president after the banquet was of a quite informal nature. The incoming and outgoing presidents, Messrs. Stirling and Macnab, were there with their wives as was also Mr. deJong, the chairman of the Vancouver Branch, and Mrs. deJong. A great many people took advantage of this opportunity for a chat with these distinguished officers. The success of this type of reception suggests that it should be continued in the future instead of the formal reception line adopted for previous meetings.

The Dance

Immediately after the banquet the annual dance of the Institute took place in the Ball Room, while "Muriel" continued to receive her guests throughout the evening in

The President's dinner at the Capilano Club (left to right): H. G. Thompson, Montreal; W. C. Watt, Toronto; H. A. McKay, London; R. C. Flitton, Montreal; S. Sillitoe, Belleville; R. L. Dunsmore, Montreal; F. L. Lawton, Montreal.

Left to right: W. N. Carey, New York, executive secretary of American Society of Civil Engineers; J. N. Finlayson, Vancouver; I. P. Macnab, Halifax; J. A. Vance, Woodstock, Ont.

the Banquet Hall. The facilities of the hotel were excellent for functions of this kind and were greatly enjoyed by everyone. It is interesting to note that two hundred young people who were not at the banquet were present for the dance.

The President's Dinner

On the evening of Tuesday, May 6th, the president's dinner was held at the beautiful Capilano Golf Club where fifty officers and guests of the Institute sat down as guests of the president.

One of the most distinguished of this latter group was William N. Carey, executive secretary of the American Society of Civil Engineers.

As usual the occasion was a delightful one and it is doubtful if the dinner has ever been held in more beautiful surroundings both inside and outside of the club.

Council Meetings

Council met twice during the week. The first session was on the morning of Tuesday, May 6th, with Dr. Macnab presiding. There were thirty-one councillors and guests present. The second meeting was in the morning of Friday, May 9th, with Dr. Stirling in the chair. This meeting is known traditionally as the first meeting of the new Council and is arranged at this time to meet the by-laws and to break up an otherwise lengthy agenda into two parts.

Conferences

The Branch Officers Conference was held on the afternoon of Tuesday, May 6th. The chairman of the Vancouver Branch, S. J. de Jong was elected chairman of the meeting and Stuart Lefeaux the branch secretary was selected for the same post with the conference. There were thirty present, being branch chairmen, vice-chairmen, secretaries, councillors and past officers.

The Conference of Students met all day Tuesday, the 6th. There was representation there from every Canadian university at which an engineering degree is given. For the first time Royal Military College was represented by an observer. R. F. Shaw, chairman of the Canadian Committee on Student Counselling in Engineering and Science, presided for the first portion of the agenda while the conference appointed a student as chairman for the concluding session. Here is a list of the student delegates:

University of British Columbia—Allan Hicks
University of Alberta—A. Majid Ibrahim
University of Saskatchewan—K. R. Fowler
University of Manitoba—Norman A. Hanks, S.E.I.C.
University of Toronto—W. J. Cooper, S.E.I.C.
Queen's University—G. W. Crook, S.E.I.C.
Royal Military College—P. S. Chisholm (observer)
McGill University—Cameron Kenny, S.E.I.C.
Ecole Polytechnique—Pierre Brosseau, S.E.I.C.
Laval University—P. E. Begin, S.E.I.C.
Nova Scotia Technical College—David M. Baker, S.E.I.C.
University of New Brunswick—James Q. Calkin, S.E.I.C.
Student Chairman—A. Majid Ibrahim
Student Secretary—Allan Hicks

An account of the deliberations of these conferences will appear later in the *Journal* after the minutes and the resolutions are received.

Panels

Two subjects were placed before two separate groups for open discussion. The first of these was "The fields of interest and activity of the provincial registration organizations and the Engineering Institute of Canada". The panel members were —Huet Massue of Montreal and R. A. McLachlan of Vancouver who presented the registration groups story and I. P. Macnab and J. B. Stirling who spoke on behalf of the Institute. H. J. MacLeod, dean of engineering at the University of British Columbia, presided.

The second panel was on "Management, Safety and the Engineer". The group was led by Dr. Lillian Gilbreth, Hon., M.E.I.C., and the panel members were—

J. B. Biker, Consolidated Mining and Smelting Company, Trail, B.C.; R. Elfstrom, British Columbia Electric Company, Vancouver, B.C.; A. Francis, Workmen's Compensation Board, British Columbia; A. B. McEwen, Canadian Industries Limited, Vancouver, B.C.; I. F. McRae, Canadian General Electric Company, Toronto, Ont.

Both these panels will be referred to in a later *Journal* after the verbatim has been received.

It can be said that the 66th annual meeting was a success—perhaps a greater success than many that preceded it, but there is no absolute scale or standard by which to judge such things—and just as well. The spotlight now swings around to the 67th meeting which will be held in Halifax May 13, 14 and 15, 1953. From the Pacific to the Atlantic is a long jump, but it does emphasize the national character of the Institute and points up its widespread responsibilities.

Many thanks to Vancouver for a good job well done.

FROM MONTH TO MONTH

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

Aids to Meet the Shortage

Persons concerned about the shortage of engineers have discussed several means by which the situation could be met, at least partially. The first thing that comes to mind is to get more Canadians to take engineering courses and the second is to look to immigration of men already educated and experienced.

Other suggestions have to do with a better use of present engineering staff, better wages to draw engineers back to the profession, blocking the border against emigration, and pushing back the age of compulsory retirement.

All these are worthy of study by employers. There is no doubt that many engineers today are not doing engineering work or are doing work at a level that could be done by a non-graduate. When employers find they want more engineers they should study their own organization to see if it isn't technicians they want—technicians that can take some of the hum-drum work off the shoulders of the engineers, thereby increasing their capacity to do engineering work.

An interesting and useful article on this phase of the problem appears in the May number of *Industrial Canada*, written by Oswald D. Johnston, M.E.I.C., P.ENG., president of the Association of Professional Engineers of Ontario, and president of Gooderham and Worts Limited. It is addressed directly to the employers. Mr. Johnston admits this of itself will not solve the whole problem but he emphasizes that it will help. His article concludes with this—

"Let's face the facts: university enrolment and graduation records *vs* the demand of booming Canada spell a growing, continuing shortage of professional engineers. Look around your office, your plant, your field staff now and make sure all your engineers are doing engineering jobs."

Sales Work

Some people maintain that engineers on sales work are wasted as far as engineering is concerned, and that they should be turned to other more technical work. This isn't as simple as it sounds. In the first place you can't just order a man to change his work. He is on sales because he likes it and has talents for it. If he doesn't want to go back to the design office, no one can make him do so.

Most sales engineers are doing really valuable engineering work. Without them there would be a great loss in efficiency. Someone has to tie in the consulting engineers or the owner's requirements to the supplier's plant. There has to be a technically qualified person to operate between these two parties. The sales engineer is the specialist in this field. No one who does business with his firm would want to see him go.

Emigration

At first glance it seems a serious loss when a Canadian engineer goes across the border—but just how serious is it? In the first place, not a high percentage are going, and in the second place the chances are they will return, and with experience that will make them more than ever useful in Canada. Great numbers have returned already and the trend will continue.

When looking at emigration to the United States, one should not overlook immigration from there. Canada is getting many American trained engineers now, particularly in the West. If you stop emigration, perhaps you would stop immigration too. No—stopping emigration is not the answer.

Compulsory Retirement

Are firms retiring their engineers too soon? Certain it is that many men still in their prime are coming on to the market because of a pension rule. However, not all of these remain unemployed. They can all get useful work with some other employer—and many do. After all they are not a loss to Canada's development but it might be more efficient if their former

Cover Picture

Four diesel units developing 6,400 horsepower, claimed to be the most powerful locomotive in Canada, made test runs over the Rockies in the Canadian Pacific Railway's Revelstoke Division. Dynamic braking controlled 3,200-ton trains on steep downhill grades without the use of air brakes. The units were manufactured by Montreal Locomotive Works.—*C.P.R. Photo.*

employers had kept them, rather than that they should start again with a new employer.

Recently the *Journal* has had a report on what has happened with a specific employer and the pensioned engineers. It makes interesting reading as it not only shows how senior engineers can continue to be useful but it tells something also about a great Canadian development. The *Journal* is indebted to the Press Bureau of the Canadian National Railways for this report and for its poignant observations. It follows immediately.

Meeting the Demand for Engineers

With Canadian industry racing ahead with a wide open throttle to keep abreast of civilian and defence demands; with frontiers being thrust back across the nation to open new and fabulous sources of natural wealth, and with new demands being made daily for and upon graduate engineers, it is ironic that Canada may be headed for a crisis in the engineering field.

Three factors seem largely responsible for this — a developing shortage of new engineers; an unwillingness among new engineers to "pioneer", and compulsory retirement at a specified age.

Despite engineering demands reaching an all time high in Canadian history, the number of Canadian youth entering this profession has of late been disappointing. This fact was emphasized by Labour Minister Milton Gregg when, in an address before the Engineering Institute of Canada at Montreal some time ago, he warned that there would be a serious shortage of graduate engineers by 1954 and noting that our nation's annual requirement of 2,000 engineering graduates would be short by 800 by that time.

Apart from the declining number of engineering students, Canada's frontier development is being hindered further by an apparently increasing number of graduates who prefer the more comfortable city and office jobs to pioneering in the northland, with its cold winters, black fly infested summers and rugged camp life.

Pensions

Well meant though it is, compulsory retirement on pension at a specified age also is hitting the nation's expansion a serious blow. It means the loss of the services of seasoned men who, possibly a little short in wind and limb, are at their prime as far as engineering "know-how" is concerned—men who have added 30 or even 40 years experience to their technical training as engineers. The physical handicaps are of less importance nowadays, since engineers reach the frontier developments by aircraft, than they were years ago when they shouldered their packsacks and trudged long miles through forests and around mountains to reach their objective.

Few people realize how many of these retired engineers are still contributing a large share to Canada's growth. This is particularly true of pensioned railway construction engineers who find a ready demand for their services in the country's development areas.

A prime example of this is taking place in northeast Quebec where one of Canada's most ambitious present-day railway construction projects is taking shape. It is the 360-mile line of the Quebec North Shore and Labrador Railway which will link Seven Islands, on the north shore of the Gulf of St. Lawrence, with Knob Lake near the Quebec-Labrador boundary and which sits astride fabulous iron ore deposits. At the end of 1950, drilling tests had indicated a reserve of 417,707,000 long tons of excellent grade ore.

No less than seven retired engineers from the Canadian National Railways — itself a development road — are now senior engineering officials with the Quebec North Shore and Labrador and pitting their knowledge against tough terrain and Mother Nature—the latter in the form of climate, black flies and mosquitoes—as they push their way northwards.

These men have brought a total of 241 years experience to the job of building this new railway, experience which in most instances began shortly after the turn of the century in the boom days of similar railway construction.

They are R. G. Cook, former chief inspector of forest products for the C.N.R. and now tie and timber agent for the new line; H. W. Fleming, former assistant chief engineer who holds the same post with the Quebec North Shore and Labrador; T. E. Little, now an inspector following his retirement as supervisor of water services for the C.N.'s St. Lawrence Division; E. R. Logie, former chief engineer for the C.N.'s Central Region and now district engineer; S. E. Waller, former assistant district engineer at Quebec and now assistant engineer; and J. E. Stokes, who became office engineer for the new road following his retirement as chief draughtsman in the regional chief engineer's office at Toronto.

Also bringing many years' experience to the project is Hector McNeill, now on loan to the Quebec North Shore and Labrador as chief engineer of construction. Prior to his moving to Seven Islands, he was assistant engineer of construction for the C.N.'s Central Region.

Ignoring arm chairs and lives of leisure, these men have adopted the slogan "Iron Ore by '54" and are now supervising the construction of the road—much of it through difficult, rocky and mountainous terrain.

For the first hundred miles out of Seven Islands, the line will snake its way around mountains, through canyon-like valleys and over swamplands and turbulent streams. Each day is filled with the roar of bulldozers and exploding dynamite as workers blast out sidewall rock cuts and inch their way northward to meet a 1954 deadline.

New Horizons

Beyond the first hundred miles the line will traverse a broad plateau 2,000 feet above sea level—fairly easy going after the initial part of the program. Already a 2,250 foot tunnel has been completed at Mile 12 and work started on a 680-foot bridge over the Moisie River. Construction is also under way at the northernmost part of the line where, 30 miles to the south at Menihek Rapids, a combined bridge and power plant will be built.

But when the smoke and noise of the dynamite and bulldozers fade away, these "vets" will have an ultra-modern railway, boasting diesel-electric locomotives, radio communications and grades that do not exceed 0.2 per cent anywhere along the route for loaded southbound trains.

Four 1,600 horsepower diesel-electric locomotive units will be used to haul each 100-car ore train. Each train will carry 10,000 tons of iron ore and it is expected that 60,000 to 70,000 tons will be delivered daily to Seven Islands during the five to six month railroading season.

According to present plans, all trains and maintenance of way track cars will be equipped with two-way radio facilities, enabling two train despatchers to supervise all train and track car movements.

The Quebec North Shore and Labrador road's locomotive and car repair shops and administrative offices are to be located at Seven Islands where large ore-loading docks will also be constructed.

Association of Professional Engineers of Alberta

In March last, announcement was made of the election of the new executive of the Alberta Association.

The president of the Association is H. H. Moor, M.E.I.C., superintendent of the Edmonton Refinery of Imperial Oil Limited. (See "Personals.")

Vice-president of the Association is R. T. Hollies, M.E.I.C., of the Waterworks Department of the City of Calgary. Past president is Harold Randle, M.E.I.C., of Calgary Power Ltd. Councillors of the Association are A. G. Donaldson, M.E.I.C., Lethbridge; Alex Frame, M.E.I.C., Edmonton; G. W. Govier, Edmonton; R. S. Woodford, M.E.I.C., Calgary; J. N. Ford, M.E.I.C., Edmonton; C. A. Stollery, M.E.I.C., Calgary; M. S. Mitchell, M.E.I.C., Lethbridge; and J. W. Young, M.E.I.C., Calgary. Representing the Association on the Dominion Council will be R. M. Hardy, M.E.I.C., Edmonton; on the E.I.C. Council, P. M. Sauder, M.E.I.C.; and on the University of Alberta faculty, J. G. Dale, M.E.I.C. Registrar of the Association is J. F. McDougall, M.E.I.C.

Corporation of Professional Engineers of Quebec

The annual meeting of the Corporation of Professional Engineers of Quebec took place on April 26.

At the annual dinner Prime Minister Louis St. Laurent, as guest speaker, told his audience of his hope that science could be directed toward the betterment of a world at peace.

The Corporation announced the following new officers: president, Louis O'Sullivan, M.E.I.C., assistant general manager of the Quebec Hydro-Electric Commission. (See "Personals.")

Vice-president of the Corporation is R. F. Shaw, M.E.I.C., of Montreal and Ottawa. P. A. Dupuis, M.E.I.C., of Quebec City is the honorary secretary-treasurer; Members of council for Montreal are Dr. T. A. Monti, M.E.I.C., and G. Lorne Wiggs, M.E.I.C.; and members of the council for Quebec City are Maurice Royer, M.E.I.C.; and Georges Demers, M.E.I.C.

Welded Ships

(From *Times Weekly Review*)

The conclusions reached by Lloyd's Register respecting the use of welding in ship construction are referred to in the latest annual report of the society. The subject has recently attracted widespread attention owing to structural failures in certain welded ships during the heavy weather last winter and, in particular, the almost simultaneous breaking in two, during February, of two American oil-tankers of the same type off the east coast of the United States.

Much use of welding was made in the United States during the last war and it can safely be said that, without it, shipping could not have been produced in the great volume which was achieved and was a major factor in the winning of the battle of the Atlantic. After the first major fractures in 1943 research was immediately initiated by a special board established in the United States. At that time welding was not used to the same extent in British shipbuilding, but the significance of the failures was promptly realized and in June, 1943, the Admiralty Ship Welding Committee was formed under the chairmanship of the late Sir Amos Ayre. Its first interim report was published in June, 1946. Both bodies carried out much research and have maintained close contact and have exchanged information. Lloyd's Register took a leading part in these and other investigations.

The Register states that since the war its staff have surveyed during construction many hundreds of predominantly welded ships to which the results of earlier experience and research have been applied, and that these ships are giving full satisfaction in service. The current rules for oil-tankers have been formulated for welded construction, this now being commonly accepted practice for these types of ships. In dry cargo vessels longitudinal framing at the bottom and strength deck is recommended and is being increasingly adopted. Safeguards against any tendency to the cracking of hulls are provided by avoiding in design sharp discontinuities and notch effects.

Guidance respecting the loading of ocean-going oil-tankers has been given to owners of tankers classed with the Register and suggestions have been made, and are being submitted, concerning the most suitable loading of many types of dry cargo ships in which welding is adopted. Briefly, welding is approved, subject to the exercise of reasonable care in the production of the material and in design and construction.

News of Other Societies

The Right Honourable C. D. Howe, Hon.M.E.I.C., Minister of Defence Production, announced recently that Canada had accepted an invitation to attend a Tri-partite Standardization Conference to discuss screw threads, limits, and fits, and drawing and drafting room practices. Representatives of the United States, United Kingdom and Canada attended the conference in New York during the week of June 2, 1952.

The Canadian delegation, representing both industry and government, was under the chairmanship of James G. Morrow, president of Canadian Standards Association.

A convocation on October 23 and 24 will commence a program to mark the centennial celebration of the inauguration of engineering courses at the University of Michigan.

The **Society of the Plastics Industry, Inc.**, New York, N.Y., announced recently the re-election as president of the Society of Gordon Brown, vice-president of the Bakelite Company.

The Third International Symposium on the Chemistry of Cement will be held in London, England, from September 15 to 20, 1952, and will be organized jointly by the Building Research Station of the Department of Scientific and Industrial Research, and the Cement and Concrete Association. Previous symposia were held at Stockholm in 1938 and at London in 1919.

Because of the specialized nature of the symposium, attendance will be by invitation only. Further particulars are available from the Division of Building Research of the National Research Council, Ottawa, Canada.

The International Machine Tool Exhibition will be held at Olympia, London, England, September 17th to October 4th.

The **Machine Tool Trades Association,** Victoria House, Southampton Row, London, W.C.1, is organizing the exhibition.

Institute Awards

At the Annual Banquet on Friday, May 9, Institute honours and awards were presented to those of their recipients who were able to attend the meeting. Appropriate occasions will be sought later for the presentation of other awards.

Honorary memberships have been granted to four distinguished members of the profession, Dr. J. A. Allan, Edmonton, Lt.-Col. F. W. W. Doane, Halifax, Mr. J. G. G. Kerry, Port Hope, Ont., posthumously to Dr. E. A. Cleveland, Vancouver. Julian C. Smith medals of the Institute awarded "for achievement in the development of Canada" have been given to Mr. F. V. Seibert, M.E.I.C., and to Mr. R. L. Weldon, O.B.E., M.E.I.C. Their biographies and those of all winners of Institute awards are presented in the following pages:

Honorary Memberships

Ernest Albert Cleveland, Hon.M.E.I.C.

The late Dr. E. A. Cleveland was born at Alma, New Brunswick, and received his early education there. He went to Vancouver as a very young man and became articled to Williams Brothers and Dawson, engineers and surveyors. On completing his articles Dr. Cleveland worked for a time under the late T. A. Noble on hydro-electric surveys and in 1894-1895 became an assistant on the International Boundary Surveys in Alaska. In the following year he was commissioned as a British Columbia

The late Dr. E. A. Cleveland, Hon.M.E.I.C.

Land Surveyor as well as a Dominion Land Surveyor. Subsequently, a short period was spent in triangulation survey for the provincial government but at the turn of the century Dr. Cleveland went into private practice as a civil engineer and surveyor. In 1910, he joined forces with Donald Cameron to form the firm of Cleveland and Cameron, during which period many important works were carried out.

In 1919 Dr. Cleveland was apointed comptroller of water rights for the Province of British Columbia, chairman of a Board of Investigation under the Water Act, and consulting engineer to the Department of Lands. During this period he was responsible for the design and construction of the Southern Okanagan irrigation project and also conducted a reconstitution and refinancing of the larger irrigation projects in the province, as well as general supervision over their reconstruction. In 1926 he was appointed chief commissioner of the Greater Vancouver Water District and chairman of the Vancouver and Districts Joint Sewerage and Drainage Board, which offices he still held at the time of his death in January, 1952.

Dr. Cleveland was a member of the American Society of Civil Engineers and of the American Water Works Association. Since 1926 he had been an active member of the Vancouver Town Planning Commission, and in May, 1936, the honorary degree of doctor of laws was conferred upon him by the University of British Columbia on the occasion of that institution's twenty-first anniversary. He became a member of the Canadian Society of Civil Engineers in March, 1914, served as a member of the Council in 1927, and as president in 1936. As chairman of the local advisory committee he was largely responsible for the great success of the Institute's Western Professional meeting held in 1934 in conjunction with the American Society of Civil Engineers.

J. G. G. Kerry, Hon.M.E.I.C.

John George Gole Kerry, Hon.M.E.I.C.

J. G. G. Kerry, of Port Hope, Ontario, was born and educated in Montreal, Quebec. He graduated with honours from McGill University with a degree of B.A.Sc. in civil engineering in the year 1886. Following graduation, Mr. Kerry spent several years in railway survey work both in Canada and the United States. He returned to Canada in 1892 to obtain his M.Eng. degree at McGill University and subsequently joined the teaching staff of the Faculty of Applied Science at McGill where he remained until 1907. Mr. Kerry, in 1898, became a partner in the firm of Smith, Kerry & Chace, consulting engineers which later was known as Kerry & Chace Limited, and remained with this company until his retirement in 1939. From 1907 until 1932 Mr. Kerry acted as consulting engineer for the Temiskaming and Northern Ontario Railway.

Mr. Kerry was active for many years in the construction and operation of power plants and paper mills. Construction work for which he was responsible included hydro-electric power plants for the Nipissing Power Company, Seymour Power & Electric Company, Canada Cement Company and Hollinger Gold Mines. Paper mill construction included plants for the Northumberland Paper & Electric Company and Canadian Paperboard Company. Executive positions held by Mr. Kerry prior to his retirement were, president, Northumberland Paper & Electric Company; president, Seymour Electric Power Company and associated companies; president, Canadian Paper Board Company; president, Quinte & Trent Valley Power Company. He was also secretary of Boundary Investments Limited. Mr. Kerry joined the Canadian Society of Civil Engineers as a Student member in 1888, was transferred to Associate membership in 1894, and became a full member in 1904. He was awarded the Gzowski Medal of the Institute for 1946 for his paper "The Winter Temperature Cycle of the St. Lawrence Waters" which appeared in the January 1946 issue of *The Engineering Journal*.

Mr. Kerry after sixty-five years of practice is still one of the outstanding engineers in Canada. His keen intellect is still producing ideas that are a challenge to the profession and to Canada. His contributions to the professional life of the Institute have been great throughout his whole professional career and are still important in the professional program of this organization.

Lt.-Col. Froncis William Whitney Doone, Hon. M.E.I.C.

Colonel F. W. W. Doane was born and received his early education at Barrington, Shelbourne County, Nova Scotia. He took up the practice of engineering in 1883 and for eight years was assistant to Dr. Martin Murphy, provincial government engineer for Nova Scotia. In 1894, Colonel Doane was appointed city engineer for the City of Halifax, and served in this capacity for thirty-three years until his retirement in 1924. On the outbreak of the first war in 1914, Colonel Doane who was at that time a member of the militia, was detailed for defence duty locally but volunteered for overseas service. Ultimately he served overseas with the Highland Brigade, and following his return to Canada continued with the militia. At the time of his retirement

from the position of City Engineer he commanded the Sixty-Third Regiment, Halifax Rifles.

On his retirement, Colonel Doane went into private practice and in 1931 became consulting engineer to the Standard Paving Maritime Limited of which his son, H. W. L. Doane, M.E.I.C., was at that time superintendent, and later became manager.

Colonel Doane joined the Canadian Society of Civil Engineers as a Student member in 1887, transferring to Associate Member in 1889, and becoming a Member in 1892. He was a councillor of the Institute in 1909 and 1911. He was one of the founders of the Nova Scotia Society of Civil Engineers, as well as the Union of Nova Scotia Municipalities. He is also a past president and Life Member of the Nova Scotia Institute of Science.

John Andrew Allan, Hon.M.E.I.C.

Dr. J. A. Allan was born at Aubrey, Quebec, in the Chateauguay Valley. Because of the unusual geology of the

Dr. John Andrew Allan, Hon.M.E.I.C.

country where he was born and brought up, he was led to pursue the study of that subject on entering McGill University from which he graduated with the B.A. degree in geology in 1907. In the following year he obtained his M.Sc. and was awarded a fellowship at the Massachusetts Institute of Technology where he continued his geological studies and obtained the degree of Ph.D. in 1912.

In the fall of 1912 Dr. Allan was appointed lecturer in the Department of Geology and Mineralogy at the University of Alberta, and became Professor of Geology in the following year. At the time of his appointment the Department of Geology and Minerology was newly established and the task of organizing the various courses of study and building up the Department fell very largely on his shoulders. Under his direction it has grown steadily both in size and strength and its high standing today is attributed to Dr. Allan's ability not only as a geologist but as a teacher and an administrator as well.

In 1919 Dr. Allan began a systematic investigation of the mineral resources of Alberta for the provincial government and he was one of those responsible for the organization of the Scientific & Industrial Research Council of Alberta, now known as the Research Council of Alberta. From the outset he has directed the Geological Survey Division of this organization whose publications contain numerous reports and maps which he has prepared dealing with the geology and mineral resources of various sections of the Province. Another outstanding contribution made by Dr. Allan was the building up of a large collection of minerals and fossils to form a geological museum at the University of Alberta which is now considered to be the finest in Western Canada. Dr. Allan's work has taken him into practically every part of the Province of Alberta as well as into Northern British Columbia. He was largely responsible for the mapping of the coal fields together with general studies in geology throughout the province and in the Rocky Mountains. His work in pioneering the development of Alberta's oil and gas resources has been equally important. In the consulting field Dr. Allan has long been recognized as an outstanding authority on engineering geology as applied to reservoirs as well as foundations for bridges and dams.

Dr. Allan is a past president of the Association of Professional Engineers of Alberta as well as the Canadian Institute of Mining and Metallurgy. He has for many years been a Fellow of the Royal Society of Canada as well as an active member of many other societies and organizations in both Canada and the United States. Dr. Allan became a member of the Engineering Institute of Canada in 1941 and retired from his post as Professor of Geology at the University of Alberta in 1949.

Frederick V. Seibert, M.E.I.C.

Julian C. Smith Medals

Awarded for "achievement in the development of Canada".

Frederick V. Seibert, M.E.I.C.

Frederick V. Seibert was born in Bruce County, in the province of Ontario. He graduated in civil engineering from the University of Toronto in 1909, returning later to take his degree of B.A.Sc. in 1912. He worked on surveys in the province of Alberta until 1917 when he joined the Royal Air Force and served until the end of the war.

Subsequently, he served in the Natural Resources Intelligence Service, Department of the Interior, for a number of years, making economic investigations of the natural resources of northern and western Canada. In 1930 he joined the staff of the Canadian National Railways as superintendent of the Department of Natural Resources at Winnipeg, later becoming industrial commissioner there which position he filled for many years.

In 1949 he was elected to the presidency of the Canadian Institute of Mining and Metallurgy and he retired from the Canadian National Railways the following year, now carrying on a consulting practice in Edmonton where he resides.

Mr. Seibert joined the Engineering Institute as an Associate Member in 1920, transferring to the grade of Member in 1922. He was chairman of the annual meeting committee when the meeting was held in Winnipeg in 1945.

R. L. Weldon, M.E.I.C.

R. L. Weldon is a well-known executive in the pulp and paper industry, who was born in Winnipeg, Manitoba, and received his earlier education in the schools of that city. He attended McGill University graduating with a degree of B.Sc. in mechanical engineering in 1917, subsequently obtaining his M.Sc. degree in 1920. On leaving university, Mr. Weldon served with the Laurentide Company Limited at Grand'Mere, Quebec, as mechanical engineer, during 1919-20. Then he joined the staff of the St. Lawrence Paper Mills Limited at Montreal and Three Rivers, where he had charge of the design of their first paper mill.

In 1923, Mr. Weldon went to the Newfoundland Power and Paper Company Limited, as designing engineer and later was appointed assistant mill manager on the commencement of operations at the new plant in Cornerbrook, Newfoundland. When this company became a subsidiary of the International Paper Company, he was appointed manager in April, 1928, director in 1929, and subsequently became chief engineer of the International Paper Company and subsidiaries in New York, which position he held from 1930 to 1936. On the reorganization of the Bathurst Power and

R. L. Weldon, M.E.I.C.

Paper Co. Ltd., in 1936, Mr. Weldon was appointed president and managing director of this company and its subsidiaries. He was president of the Canadian Pulp and Paper Association in 1942 and chairman of the executive board in 1945.

During the recent war, Mr. Weldon was newsprint administrator at the War-

time Prices and Trade Board from September 1942 until May 1943; deputy coordinator, Pulp and Paper Products Administration 1943 to 1945; and consultant to same 1945 to 1947. Mr. Weldon joined the Institute as a Student Member in 1915 and was transferred to Junior in 1918. He became an Associate Member in 1921, and a Member in 1931. He is at present a member of the Finance Committee of the Institute.

Gzowski Medal

Awarded for the best paper of the medal year.

F. M. Wood, M.E.I.C.

F. M. Wood, M.E.I.C., has been awarded the Gzowski Medal of the Institute for his paper "Graphical Solutions of Partial Differential Equations with Engineering Applications", which was published in May 1952 as Technical Paper No. 4, of the Institute.

F. M. Wood, M.E.I.C.

Professor Wood, who is professor of mathematics at Queen's University, Kingston, Ont., was awarded the Gzowski Medal on another occasion, for the year 1930, for a paper entitled "Short Monograph on Nomography".

He received his B.Sc. and M.A. degrees from Queen's University in 1911, and 1914, after which he served in the First World War in the engineers, artillery, and as a pilot in the R.F.C. and R.A.F.

He lectured at Queen's from 1919 to 1923, and worked also as a resident engineer for the Lethbridge Northern Irrigation District. He was for two years in the hydraulic department of Dominion Engineering Works at Lachine, Quebec, and in 1925 was appointed professor in civil engineering at McGill University. He remained at McGill until 1946 when he received the appointment to his present position at Queen's University.

Professor Wood was a representative of the Institute on the A.S.M.E. Committee on Water Hammer at one time.

Duggan Medal and Prize

Awarded for papers dealing with the use of metals for structural or mechanical purposes.

D. G. Elliot, M.E.I.C.

D. G. Elliot, M.E.I.C., of Montreal, has been awarded the Duggan Medal and Prize for his paper "Recent Canadian Developments in the Cold Riveting of Aluminum", which was written in collaboraton with Mr. Ernest Anders, and was published in the June 1950 issue of *The Engineering Journal.*

Mr. Elliot was born at Darjeeling, India. He studied in Scotland, at University of Edinburgh graduating in 1930 with honours in civil engineering.

He became associated with Monsarrat and Pratley, Montreal, as an assistant engineer in 1930, working on steel and concrete design. He was assistant supervising engineer for the firm on the construction of the foundation piers of the Ile d'Orleans Bridge in 1934.

D. G. Elliot, M.E.I.C.

He joined the Anglo-Newfoundland Development Company at Grand Falls, Nfld., in 1935, as a designing draughtsman, and worked as assistant mill manager until 1939 when he returned to Monsarrat and Pratley in Montreal. He joined the Aluminum Company of Canada, Montreal, in 1940, going to Aluminium Laboratories Ltd. at Montreal in 1946 as chief draughtsman.

He is a member of the American Society of Civil Engineers.

Leonard Medal

Awarded for papers on mining subjects.

Dr. G. S. Hume

Dr. G. S. Hume, O.B.E., of Ottawa, Ont., has been awarded the Leonard Medal of the Institute and of the Canadian Institute of Mining and Metallurgy for his paper "Utilization of Natural Gas in Canada", which was printed in the September 1951 issue of *The Engineering Journal.*

Dr. Hume is director-general of scientific services of the Department of Mines and Technical Surveys. He has, on previous occasions, received awards of professional associations, among them the Barlow Medal of C.I.M.M. in 1926; the Plummer Medal of the E.I.C. in 1931; the Leonard Medal of the E.I.C. and the C.I.M.M. in 1947.

Dr. Hume graduated from University of Toronto in 1915 with honours in geology and mineralogy. After service in the First World War he attended Yale University and received his doctorate in 1920, specializing in stratigraphy. After a short lectureship at McGill University he joined the Geological Survey of Canada, being given as his first assignment a special study of Canadian resources of petroleum and natural gas.

Dr. G. S. Hume

From 1941-1945 Dr. Hume was on loan to the office of the Oil Controller of the Department of Munitions and Supply In recognition of his wartime services he was later awarded the O.B.E.

He became chief of the Geological Survey of Canada in 1947; director of the Mines, Forests and Scientific Services Branch of the Department of Mines and Resources in 1949; and on the creation of the new Department of Mines and Technical Surveys in 1950 he was appointed director general of scientific services.

Dr. Hume is a member of the Canadian Institute of Mining and Metallurgy, the Geological Society of America, and the American Association of Petroleum Geologists. He is also a fellow of the Royal Society of Canada.

Plummer Medal

Awarded for papers on chemical and metallurgical subjects.

R. H. Hall

R. H. Hall has been awarded the Plummer Medal of the Institute for his paper "Rotary Lime Kiln Operation" which appeared in the December 1951 issue of *The Engineering Journal.*

R. H. Hall

Mr. Hall is from Regina, a graduate of the University of Saskatchewan in

chemical engineering, class of 1941. He joined Shawinigan Chemicals immediately, and two years later undertook special work for the Company in the rubber laboratories of the National Research Council, Ottawa.

In 1944 he joined the paratroop corps, Canadian Army, training at Shilo, Man. After the war he took his master's degree at the University of Toronto, and in 1946 returned to Shawinigan Chemicals at Shawinigan Falls, Que. He began work for B.A.-Shawinigan in 1951, and was made assistant plant manager in 1952.

Keefer Medal

Awarded for papers on civil engineering subjects.

Dr. T. A. Monti, M.E.I.C.

Dr. T. A. Monti, M.E.I.C., has been awarded the Keefer Medal of the Institute for his paper "Economy in Rigid Frames", which was published in July 1951 as Technical Paper No. 5 of the Institute.

Dr. Monti graduated in civil engineering from Ecole Polytechnique, Montreal, in 1941. In 1947 he received the degree of doctor of science from the Ecole Polytechnique.

Dr. T. A. Monti, M.E.I.C.

From 1941 to 1943 he worked as a mechanical designer for Dominion Bridge Company, Montreal; and he was for four years thereafter a consulting engineer in the mechanical field. He joined the National Research Council in 1947 and was for two years the representative in the Montreal area. At the present time he is a consulting engineer with Royer, Letendre and Associates, an appointment made this year; and he has been district engineer in Montreal for the Canadian Institute of Steel Construction, since. 1949; and an assistant professor at Ecole Polytechnique since 1945.

The winner of the Ernest Marceau Prize of the Institute in 1941, Dr. Monti has been active in the Montreal Branch and the Junior Section of the Branch, his activities having included the chairmanship of the Junior Section in 1945, and serving on the executive committee of the Montreal Branch in 1951. He has been active also in the Corporation of Professional Engineers of Quebec, serving on the membership committee in 1950, and on the executive in 1952.

Ross Medal

Awarded for papers on electrical engineering subjects.

P. L. Mathewson, M.E.I.C.

P. L. Mathewson, M.E.I.C., has been awarded the Ross Medal of the Institute for his paper, "Application of Diesel Electric Locomotives", which was printed in the September, 1950 issue of The Engineering Journal.

Mr. Mathewson graduated from the University of British Columbia with the degree of B.A.Sc. in electrical engineering in 1927. He was for three years with the Canadian Westinghouse Company in Hamilton, Ont.; joining the Canadian National Railways in 1930 he was in the central region motive power department at Toronto until 1937, when he was transferred to Montreal. He has worked in the motive power, research and development, and transportation departments. He is a transportation engineer in the Transportation Department at present.

P. L. Mathewson, M.E.I.C.

He is a member of the Corporation of Professional Engineers of Quebec.

H. N. Ruttan Prize

John Henry, S.E.I.C.

John Henry, S.E.I.C., of Kingston, Ont., has been awarded the H. N. Ruttan Prize of the Institute for his paper "Foundry Work".

John Henry, S.E.I.C.

Mr. Henry is employed as an engineering assistant in the works engineering department of Canadian Industries Limited nylon plant at Kingston, Ont.

In 1951 he graduated from the University of British Columbia with the degree of B.A.Sc. in mechanical engineering. He did summer work in the maintenance department of the Coast Foundry Company, Vancouver.

He served in the Royal Canadian Navy during World War II.

John Galbraith Prize

William A. Connelly, Jr.E.I.C.

William A. Connelly, Jr.E.I.C., has been awarded the John Galbraith Prize of the Institute for his paper entitled "Spot Welding".

Mr. Connelly studied at Ottawa Technical High School. Proceeding to McGill University he received the bachelor of engineering degree in mechanical engineering (industrial) 1949. After postgraduate studies he expects to graduate in factory management at Lincoln Institute in 1953.

William A. Connelly, Jr.E.I.C.

As a warrant officer in the R.C.N.V.R. in 1943-44, he was on radar duty on Canada's East Coast. During the summers of 1946, 1947, 1948, he worked with the Bell Telephone Company of Canada. In 1949, he joined the Canadian Westinghouse Company and followed the graduate engineering course. Since October, 1951 he has been a time study and methods engineer, in the Engineering Products Division of R.C.A. Victor Company Limited.

Mr. Connelly is a member of the Society for the Advancement of Management; of the Association of Professional Engineers of Ontario; and of the McGill Graduate Society.

Phelps Johnson Prize

Ronold E. Dyson, S.E.I.C.

Ronald E. Dyson, S.E.I.C., of Montreal, has been awarded the Phelps Johnson Prize of the Institute for his paper "Fitting a New Steam Drum to a Marine Boiler".

Mr. Dyson graduated from McGill University with honours in civil engi-

Ronald E. Dyson, S.E.I.C.

R. Noel, S.E.I.C.

neering in May, 1951, and is now studying to be an actuary.

His early education was acquired at the Chatham Junior Technical School and at H.M. Dockyard School Chatham, England. He served a 5-year apprenticeship as a fitter and turner. Commissioned in the Royal Navy as a sub-lieutenant (e) in 1941, he served as an engineer officer until 1947 when he was awarded the Ajax Hospitality Scholarship to McGill University.

Ernest Marceau Prizes

R. Noel, S.E.I.C.

R. Noel, S.E.I.C., of Ottawa, Ont., has been awarded an Ernest Marceau Prize of the Institute for his paper "Controle Electronique des Chalumeaux Oxy-Acetyleniques dans le Decoupage des Plazues Metalliques".

Mr. Noel is from Rimouski, Quebec. He served with the R.C.A.F. as a navigator from 1940 to 1945, after which he studied at Ecole Polytechnique, Montreal, graduating in 1951.

Since graduation he has worked for Defence Research Telecommunication Establishment, electronics laboratory in Ottawa, as a research scientist.

Gilles Lefebvre, S.E.I.C.

Gilles Lefebvre, S.E.I.C., Montreal, has been awarded an Ernest Marceau Prize of the Institute for his paper entitled "Installation d'une Unite de Demineralisation de l'Eau d'Alimentation d'une Bouilloire".

Mr. Lefebvre, a Montrealer, studied at Lajoie School, at Catholic High School, and at Ecole Polytechnique, where he received a degree in chemical engineering with honours in 1951. He is presently engaged on a research project in view of a master's degree in chemical engineering, also at Polytechnique. Afterward, he plans to register for post-graduate studies at McGill University in view of a Ph.D. degree.

The Marceau Prize is Mr. Lefebvre's second award from the Institute, since he had taken the second place for the Students' Night Oratorical Contest in February 1950. It is also the third prize awarded for his graduation thesis, which had already brought him a Silver Medal from L'Association des Diplomés de Polytechnique for the best thesis in chemical engineering, and a cash prize from the Society of Chemical Industry in their annual inter-university chemical papers contest.

Martin Murphy Prize

James Q. Calkin, S.E.I.C.

James Q. Calkin, S.E.I.C., of Woodstock, N.B., has been awarded the Martin Murphy Prize of the Institute for his paper entitled "The Trenche Development".

Mr. Calkin is a mechanical engineering student of the University of New Brunswick, class of 1953.

Born in Woodstock, N.B., he studied at Woodstock High School. Entering University of New Brunswick in 1946, he has worked in the summers for the Highway Division of the New Brunswick Public Works Department; for the Shawinigan Engineering Company Limitted, at La Trenche, Quebec; and in the mechanical department of the Canadian National Railways Atlantic Region. at Moncton, N.B.

He held the Leonard Foundation Scholarship from 1946 to 1948, and for the year 1951-52. He was awarded the scholarship of the New Brunswick Association of Professional Engineers for 1951-52.

Gilles Lefebvre, S.E.I.C.

James Q. Calkin, S.E.I.C.

Found

A silver cigarette case was found in the President's suite after the annual meeting in Vancouver. Engraved initials on the case are "A.R.F."

The owner is invited to write to Headquarters in order to recover it.

Personals

News of the Personal Activities of Members of the Institute

I. R. Tait, M.E.I.C., former chief engineer of the engineering department of Canadian Industries Limited, has been elected a vice-president of the Institute.

Mr. Tait relinquished his post with C.I.L. this year, but at the request of the company, will continue to serve in the capacity of consulting engineer. He joined this company as an electrical engineer, subsequently becoming assistant chief engineer in 1929, and chief engineer in 1939.

Mr. Tait was born in Montreal and studied at McGill University, graduating with a B.Sc. degree in electrical engineering in 1913; he also made a special study of electrochemistry. After graduation, he worked for two years with the Canadian Westinghouse Company at Hamilton, Ontario.

He is affiliated with the Association of Professional Engineers of Ontario, Manitoba, British Columbia, and with the Corporation of Professional Engineers of Quebec. He is a member of the American Society for Testing Materials, the Electrochemical Society and the National Fire Protection Association.

Mr. Tait joined the Institute in 1922 as an Associate Member, transferring to Member in 1940, and is a past chairman of the Montreal Branch. He has served on the Finance Committee, on the Publication Committee, and on the Committee of Employment conditions.

He is also a member of the Metropolitan Board of Directors of the Montreal Y.M.C.A.

I. R. Tait, M.E.I.C.

R. E. Jamieson, O.B.E., M.E.I.C., has been elected treasurer of the Institute. Professor Jamieson has just recently been appointed dean of the engineering faculty of McGill University.

Mr. Jamieson was professor of civil engineering at McGill University and

R. E. Jamieson, M.E.I.C.

chairman of the department. He received this appointment in 1932, twelve years after joining the Faculty of Engineering as a lecturer in mathematics and civil engineering. He graduated from McGill in 1914, and did post-graduate work there, after service overseas in the first world war as a lieutenant. He received the degree of M.Sc. in 1920.

During the recent war, Professor Jamieson acted as director general of the Army Engineering Design Branch of the Department of Munitions and Supply at Ottawa. After his resignation from this position in 1945, he remained a member of the Army Technical Development Board.

He is a past president of the Corporation of Professional Engineers of Quebec. He has served on many committees of the Engineering Institute. He is vice-chairman of the executive committee of the Canadian Standards Association.

J. B. Stirling, M.E.I.C., president of the Institute, has been appointed honorary colonel of the 3rd. Field Engineer Regiment (Res.) of Montreal.

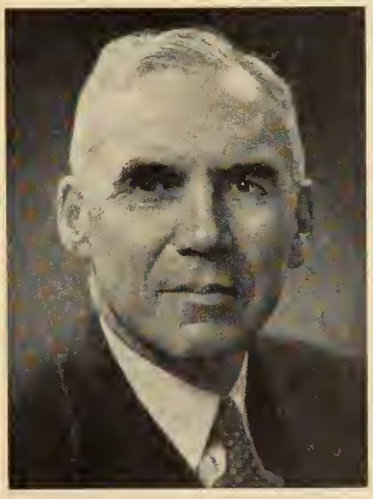
J. M. Wardle, C.B.E., M.E.I.C., has retired from the Public Service of Canada as director of the Engineering and Water Resources Branch of the Department of Resources and development in Ottawa, after 39 years of activity.

Mr. Wardle, a native of British Columbia, entered the Public Service in 1913 after graduating with honours in civil engineering from Queen's University with a B.Sc. degree. He entered the, then, Interior Department and shortly after joined the staff of the National Parks as an engineer in the early days of the development of the Service.

In 1918 he was appointed superintendent of Banff National Park, the first superintendent to be appointed from the Civil Service. Three years later he became chief engineer of the National Parks and in 1929 his responsibilities were extended to include supervision of all the Western Parks. During the depression years, when more than 5,000 men were employed on highway building, construction and general Parks development projects, Mr. Wardle was in overall charge of the program. In 1935 he became Deputy Minister of the Interior, 3 years before the department was amalgamated into the Department of Mines & Resources. At that time he was appointed director of the Surveys and Engineering Branch, which included engineering and construction services, the Geodetic and Hydrographic Surveys, the Dominion Water Power Bureau, Dominion Observatories and the International Boundary Commission.

In 1947 he was appointed director of Special Projects, International Boundary Commissioner for Canada and Dominion member of the newly-created Eastern Rockies Forest Conservation Board. A year later, when the Northwest Territories Power Commission was formed, he was appointed chairman.

When, in 1950, the Department of Mines and Resources was re-organized to form three departments, Mr. Wardle was appointed director of the Engineering and Water Resources Branch of the new Department of Resources and Development. The administration of the provisions of the Trans-Canada Highway Act and Agreements was one of the important responsibilities assumed by Mr. Wardle, and he has been actively associated with this major Federal-Provincial project. Other roads with which his long engineering career has



J. M. Wardle, M.E.I.C.

been connected are the main East-West road through Banff and Yoho Parks.

the Banff-Windermere Highway, Banff-Jasper and Edith Cavell Highways and the International Belly River Road, all within National Park areas.

In recognition of his work in completing the Banff-Windermere Highway between Castle Mountain, Alberta and Radium Hot Springs, in British Columbia (1920-1923), the first highway through the central rockies, the National Board of Geographic Names recommended that a peak be named after him. Mount Wardle (9,218 feet) stands in Kootenay National Park, B.C., and is skirted by the Banff-Windermere Road. It forms part of the Vermilion Range of the Rockies.

Outside Federal Government areas, Mr. Wardle was responsible for construction of the Prince Rupert Highway between Hazelton and Prince Rupert, B.C., built as a national defence project during the last war, and the Golden-Revelstoke Highway. In 1942, he directed work camps established in the vicinity of Revelstoke, Hope and Princetown, B.C., and the Yellowhead Pass.

In 1931-1933, Mr. Wardle was appointed Canadian Government Member on the International Fact-Finding Committee created to investigate the feasibility of building a highway to Alaska through B.C. and the Yukon; later he was a member of the B.C.-Yukon-Alaska Highway Commission established to determine highway route sand costs.

Mr. Wardle is a life Member of the Institute, and a Professional Engineer for the Province of Ontario. He was created a Commander of the British Empire by the late King George VI. For 4 years he was president of the Trail Riders of the Canadian Rockies; and has served a 6-year term as councillor of the Village of Rockcliffe Park, in Ottawa.

He also represented the Federal Government in an engineering capacity on several major Federal-Provincial highway projects such as the Cranbrook-Kootenay Park Highway and King George V Highway in British Columbia.

After a brief vacation Mr. Wardle plans to remain active in some branch of the engineering profession.

R. M. Richardson, M.E.I.C., of Saint John, N.B., has been elected president of the Dominion Council of Professional Engineers of Canada.

Mr. Richardson was born in Nova Scotia and is a graduate of McGill University where he received a B.Sc. degree in 1924. Soon after graduation he joined the Bell Telephone Company and worked with the Company in Ottawa and Montreal until 1941 when he went to the Maritimes and joined the New Brunswick Telephone Company Limited.

He is a past graduate of the New Brunswick Association of Professional Engineers.

T. D. Stanley, M.E.I.C., of the Calgary Power Company, Alberta, has been elected to serve as chairman of the Calgary Branch of the Institute.

J. G. Schaeffer, M.E.I.C.

Mr. Stanley has been with the Calgary Power Company since 1935, serving in a number of capacities. In 1937 he was appointed assistant engineer to the Northern Division supervisor, and he became assistant engineer in 1940. In 1942, he was appointed assistant production superintendent of the Company and became production superintendent in 1949.

Mr. Stanley is a 1929 graduate of the University of Alberta; he obtained a B.Sc. degree in electrical engineering from the same University in 1932 and a M.Eng. degree from McGill University in 1933. From 1928 to 1934 he was a sessional demonstrator in physics at the University of Alberta and also took an extra post graduate course in electrical and civil engineering at the University from 1933 to 1934. He was a councillor of the Association of Professional Engineers of Alberta in 1950 and 1951.

J. G. Schaeffer, M.E.I.C., of Regina, has been elected to serve as chairman of the Saskatchewan Branch of the Institute.

Mr. Schaeffer did summer work as a rodman and inspector in the City Engineer's Department at Regina in 1921, and in 1922 as instrument man with the Department of Highways of the Government of Saskatchewan.

He graduated in civil engineering from Queen's University in 1923 and then

R. M. Richardson, M.E.I.C.

T. D. Stanley, M.E.I.C.

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L. O'Sullivan, M.E.I.C.

worked with the City of Regina as sewage engineer and superintendent of sewage disposal works. In 1928, he was with Underwood & McLellan, consulting engineers at Saskatoon, until 1937 when he returned to Regina as engineer with the Provincial Department of Health. In 1947 he was appointed director of the Division of Sanitation of the Provincial Health Department of Saskatchewan.

Louis O'Sullivan, M.E.I.C., has been elected to serve as president of the Association of Professional Engineers of Quebec.

Mr. O'Sullivan is assistant general manager of the Quebec Hydro-Electric Commission. A graduate of McGill University, he obtained his B.Sc. degree in civil engineering in 1921. From 1921 to 1923 he worked with the City of Montreal on the construction of the new aqueduct canal. He then joined the Montreal Light, Heat and Power Consolidated where he was, in turn, field engineer, designing engineer, and transmission and right-of-way engineer until 1942 when he was appointed general executive assistant of the Company. In 1945 shortly after the Hydro Commission took over Montreal Light, Heat and Power properties, Mr. O'Sullivan was appointed to the newly created post of assistant general manager.

He is a member of Council of the Institute, the Quebec Land Surveyors; a member of the Canadian Engineering Standards Association, the Canadian Electrical Association, the Montreal Board of Trade, American Management Association and the Electrical Club of Montreal.

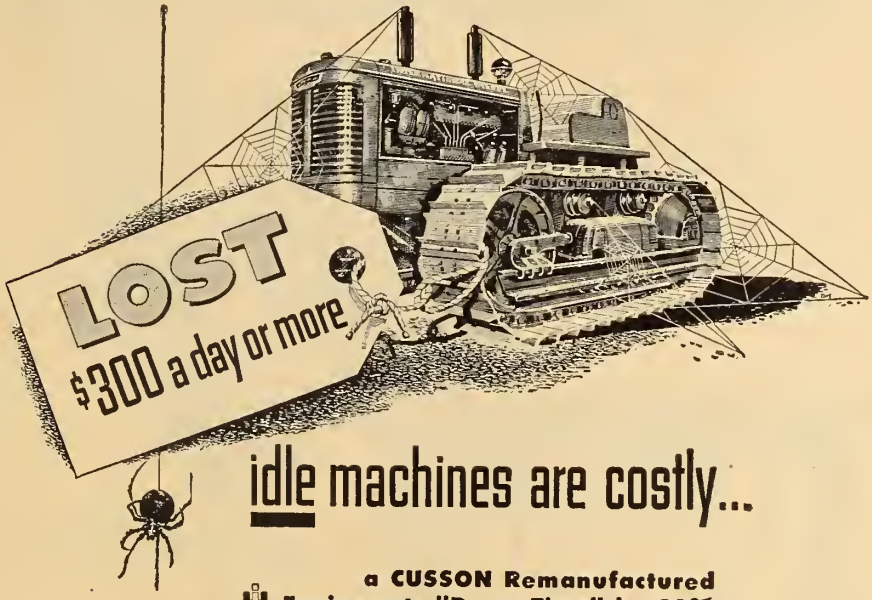
The Corporation of Professional Engineers of Quebec also announced the following new officers: R. F. Shaw, Montreal, vice-president; P. A. Dupuis, Quebec City, honorary secretary-treasurer; Maurice Royer and Georges Demers, Quebec City, members of Council; Dr. T. A. Monti and G. Lorne Wiggs, Montreal, members of council.

I. S. Patterson, M.E.I.C., has been appointed general sales manager of the English Electric Company Limited of St. Catharines, Ontario. Previously, he was manager of the central station sales for the Company, and earlier he was manager of the Winnipeg Office.

Mr. Patterson is a 1928 graduate in electrical engineering from the Nova Scotia Technical College. He first worked with the Canadian General Electric Company at Peterborough, and after a period of training in Peterborough, Toronto and Schenectady, N.Y., he was appointed, in 1930, to the Montreal office of the Company as sales engineer. In 1942, he was loaned to the Wartime Bureau of Technical Personnel in Ottawa, and was chief executive of the Bureau when he resigned after four years service with the Department of Labour. He joined the English Electric Company at Winnipeg in 1946.

L. C. Jacobs, O.B.E., M.E.I.C., has retired from his position as deputy minister

I. S. Patterson, M.E.I.C.



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with the Department of National Defence at Ottawa, Ont., and is moving to Bolton Centre, Que. Mr. Jacobs will continue to act in the capacity of consultant on engineering problems.

He was previously with the Power Corporation of Canada Limited, Montreal, from 1926 until World War II, when he served with the Department of Munitions and Supply in Ottawa, after which he returned to the Power Corporation until joining the Department of National Defence.

Mr. Jacobs is a graduate of the University of Manitoba and had worked for a number of years with the Algoma Central Railway and with the Foundation Company Limited.

He served the Institute as treasurer in 1947.

P. E. Radley, M.E.I.C., is project engineer for the Aluminum Company of Canada Limited, at Vancouver, B.C.

Mr. Radley joined the Aluminum organization in 1923 at Shawinigan Falls as a member of the technical department. From 1930 to 1939 he was in Arvida, Que., after which he was assigned to duties in England. On his return to Canada he was made works manager at Arvida. In 1944 he was named manager of the Smelter Division and continued to hold various posts leading up to the appointment, in 1948, of assistant general manager in charge of engineering, purchasing and traffic.

He entered McGill University after serving as a gunman in the artillery in the First World War and in 1923, he graduated with a B.Sc. degree in chemical engineering.

W. A. Newman, C.B.E., M.E.I.C., chief of motive power and rolling stock, Canadian Pacific Railway, has received an honorary degree of doctor of science from Queen's University.

Mr. Newman has previously received other honours from American organizations; the American Society of Metals selected him in 1948 to receive their distinguished service award, and in the same year the Engineering Foundation appointed him as a member of its research procedure committee.

He has also been one of the Institute's members on the advisory council of the Canadian Welding Bureau, a division of the Canadian Standards Association.

He is a graduate from Queen's University, and is a trustee of the University. He has served as a member of the engineering committee for the industrialization of atomic energy with the National Research Council. He is a fellow of the American Society of Mechanical Engineers. In 1946 he received the award of C.B.E.

W. E. MacDonald, M.E.I.C., commissioner of water works for the City of Ottawa has been presented with the Fuller Award of the American Water Works Association.

This award is given each year to members of the American Water Works Association for their distinguished service in the water supply field and in commemoration of George Warren Fuller, one of America's most eminent engineers. The award was conferred on Mr. MacDonald by the Canadian Section of the Association. He is a past-chairman of the Canadian Section.

W. E. MacDonald, M.E.I.C.

Mr. MacDonald is a registered professional engineer in the Province of Ontario. Other memberships and offices include those of director, A.W.W.A.; member of Canadian Engineering Standards Association; member of the New England Water Works Association.

He entered the service of the Corporation of Ottawa in 1912 as draughtsman and leveller. In 1914, he was assigned to the Pitometer Company at New York for special training in waste water surveys and in 1915 he was assign-

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ed as assistant to the firm of R. S. & W. S. Lea, consulting engineers, Montreal, Que. In 1916, he was associated with the firm of J. B. McRae, consulting engineers, Ottawa, Ont., engaged in various water works projects.

He became assistant water works engineer at Ottawa in 1917 and in 1931 was appointed to the position of city water works engineer taking complete charge of the design, maintenance and operation of the entire water works of the city. His appointment as Commissioner of Water Works was in 1950.

R. E. Heartz, M.E.I.C., president of the Shawinigan Engineering Company Limited, Montreal, has been awarded the honorary degree of doctor of laws by the Mount Allison University at Sackville, N.B.

Mr. Heartz was appointed president of Shawinigan Engineering early in 1951. He had become associated with the Company in 1920. He had graduated from McGill University in 1917.

He is a past chairman of the Montreal Branch of the Institute, and has served the Institute as a councillor and vice-president, and on the Finance Committee.

G. H. Heyn, M.E.I.C., of Toronto, is acting in a private capacity as project engineer representing E. & B. Cowan, consulting engineers of Montreal, in connection with the St. Lawrence Corporation's expansion program at Red Rock, Ont.

A. R. Harrington, M.E.I.C., has been appointed assistant manager of the Nova Scotia Light and Power Company, at Halifax, Nova Scotia.

Mr. Harrington is a graduate of the Nova Scotia Technical College where he received a degree in electrical engineering in 1936; he joined the Nova Scotia Light and Power Company in the same year.

Brigadier G. Walsh, C.B.E., D.S.O., M.E.I.C., is commander of the 27th Canadian Infantry Brigade Group of the Canadian Army in N.W. Europe.

Brigadier Walsh has a distinguished war record having served as Brigadier and chief engineer with Main H.Q. of the First Canadian Army Overseas. He was awarded the Distinguished Service Order for gallantry in the Sicilian campaign in 1943, and in 1944 was made a C.B.E.

He is a graduate of the Royal Military College for 1930 and received a degree of B.Eng. from McGill University in 1933, after which he went to the school of Military Engineering at Chatham, Kent, England, until 1935 when he returned to Canada with the Department of National Defence. He then served at a number of posts in Eastern Canada at Montreal and Halifax and returned to the Royal Military College late in 1937 to become engineering works officer. In 1938 he was an instructor at the Petawawa Camp, and in 1939 he was appointed district engineer officer of Military District No. 2 (Toronto) and held this post until 1940 when he was transferred to a Pioneer Battalion with the rank of temporary major.

He was promoted to Brigade Major in 1941 and raised to the rank of lieutenant-colonel, Royal Canadian Engineers, in 1942. He was promoted to his present rank in 1944.

C. H. Templeton, M.E.I.C., has left his position as chief engineer of the Greater Winnipeg Dyking Board at Winnipeg, Manitoba, to join the Marwell Construction Company Limited at Trail, B.C.

Previously he was assistant to the chief engineer of the Fraser Valley Dyking Board at Vancouver, B.C., from 1948 to 1950.

Mr. Templeton graduated in mining engineering from the University of Alberta in 1943 and subsequently worked with Metcalfe Hamilton, Kansas City Bridge Company on the construction of services and airports along the Alaska highway; with the Department of Mines and Resources at Banff, on surveys and design of highways, and with the McColl Frontenac Oil Company Limited in British Columbia on the construction of bulk stations and service stations.

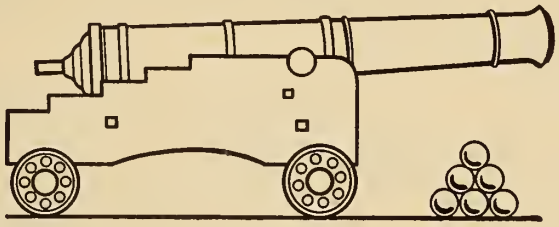
C. M. Hare, M.E.I.C., is with the newly formed engineering division of the Indian Affairs Branch of the Department of Citizenship and Immigration, at Ottawa, Ont.

Previously, Mr. Hare was senior engineer with H. W. Lee, M.E.I.C., consulting engineer at Ottawa. Before this he worked in the plant engineer's office of Noranda Mines Limited, Que., and in 1949 was city engineer for the city of Rouyn, P.Q.

Mr. Hare is a graduate of McGill University where he received a degree in civil engineering in 1929.

J. H. Smith, M.E.I.C., has been appointed general manager of the newly formed Wholesale Division of the Canadian General Electric Company.

NOTICE SOMETHING?



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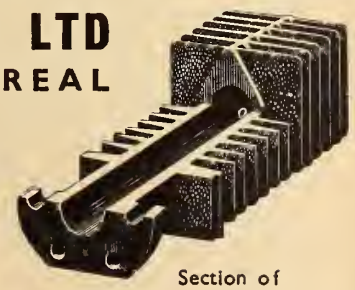

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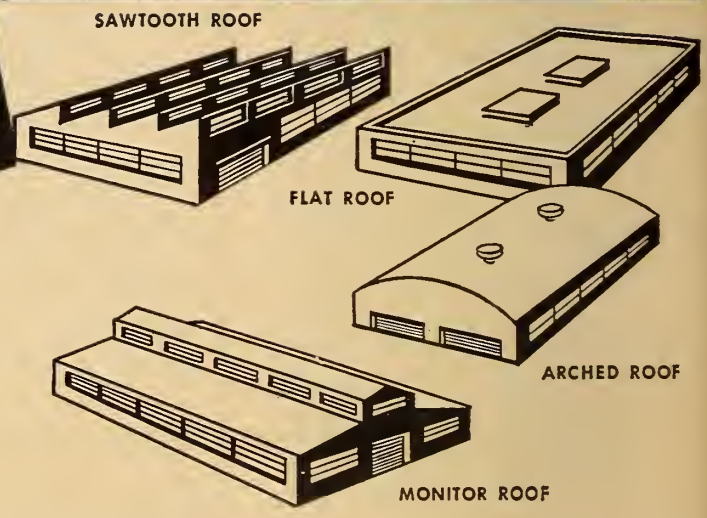

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Formerly, Mr. Smith was manager of the Apparatus Division of the Company Toronto District. He graduated from the University of New Brunswick with a B.Sc. degree in electrical engineering. He received the degree of M.Sc. in 1942. He followed Canadian General Electric's test training and held a number of sales engineering appointments in Toronto and Hamilton. In the Toronto District he was Supply Division manager, 1945-1948; and Apparatus Division manager, 1948-1951.

Mr. Smith is vice-president of the Association of Professional Engineers of Ontario; a member of A.I.E.E., and of the Toronto Board of Trade.

J. S. Keenan, M.E.I.C., has been appointed general manager of the Industrial Products Division of the Canadian General Electric Company. This division is one of five self-contained Operating Divisions of the Company, the organization of which was recently announced by the Company, as a plan to decentralize its operations, and permit greater specialization in service.

Formerly, Mr. Keenan was manager of the supply department. He is a graduate from the Massachusetts Institute of Technology in electrical engineering. He joined the General Electric Company in Schenectady in 1923, and a year later transferred to the Canadian General Electric Company where he held a number of appointments in the field of supplies and apparatus. Since 1936 he has been manager of the Company's supply department responsible for a wide variety of consumer and industrial products.

Mr. Keenan has served as president of the Canadian Electrical Manufacturers Association and the Electric Club of Toronto; also as vice-president of the Electric Service League of Ontario and the Canadian Electrical Council. He is a member of the Association of Professional Engineers of Ontario and vice-president of the International Alumni Association.

F. L. Lawton, M.E.I.C., chief engineer of the power department of Aluminium Laboratories Limited has been honoured by the American Institute of Electrical Engineers with the grade of fellow.

This honour was conferred upon Mr. Lawton for his achievements in development and operation of large power plants. He has also written papers on hydro-electric subjects.

Mr. Lawton is chairman of the Montreal Branch of the Institute and vice-president of the Canadian Electric Association. He is a past vice-president of the American Institute of Electrical Engineers.

Col. A. S. Lowe, M.C., T.D., M.E.I.C., has joined Sandford Fawcett and Partners, consulting civil engineers, in London, England.

Until recently, Mr. Lowe had been an engineering inspector of the Ministry of Housing and Local Government, in London.

He graduated in mining engineering from the Birmingham University in 1922 and is a member of the Institution of Civil Engineers and of the Institution of Mechanical Engineers of Great Britain.

R. D. Meagher, M.E.I.C., is with the British American Oil Company at Clarksons Refinery, Clarksons, Ontario; until recently he had been a mechanical superintendent for this Company at Montreal, Que.

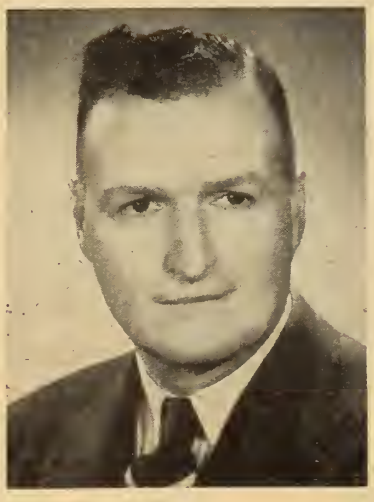
Mr. Meagher graduated in mechanical engineering from McGill University in 1938.

H. H. Moor, M.E.I.C., has been elected to serve as president of the Association of Professional Engineers of Alberta; he served as vice-president of this Association in 1951.

Mr. Moor is superintendent of the Edmonton Refinery of Imperial Oil Limited.

Professor F. L. West, M.E.I.C., dean of the Faculty of Science of Mount Allison University, at Sackville, N.B., has been awarded the honorary degree of doctor of engineering by the Nova Scotia Technical College.

Professor West graduated in civil engineering from McGill University in 1916 and went to Mount Allison after serving with the R.C.E. in the First World War. He was successively professor of civil engineering, professor of engineering, and director of the McClelan School of Engineering at Mount Allison, before being appointed dean of the Faculty of Science



W. R. Mitchell, M.E.I.C.
Chairman of Border Cities Branch

B. L. Davis, M.E.I.C.
Chairman of Saguenay Branch

Announcements of the election of Mr. Mitchell and Mr. Davis as chairmen of their Branches were made in a previous issue of the *Journal*.

in 1949. After commanding the New Brunswick Rangers early in the recent war, and some duty at National Defence Headquarters, he commanded the Khaki University overseas for some time.

L. L. Youell, M.E.I.C., has been appointed vice-president of Stone and Webster Canada Limited.

Mr. Youell served as an artillery officer overseas in World War I and graduated from the University of Toronto in mechanical engineering in 1920. After six years in engineering work in Canada he spent nineteen years with a leading chemical company in the United States.

In 1945 he joined Stone and Webster to return to Canada as its engineering representative. Since the formation of Stone and Webster Canada Limited, in 1950, he has been manager of its head office in Toronto.

Mr. Youell is a member of the Association of Professional Engineers of Ontario and of the American Society of Mechanical Engineers.

A. A. B. McMath, M.E.I.C., has been transferred by the Howard Smith Paper Mills Limited, from Cornwall, Ont., to the Crabtree Division at Crabtree Mills, Quebec, as assistant plant manager.

Mr. McMath joined the staff of Howard Smith Paper Mills Limited in 1947. Previously, he was with the Foundation Company at Montreal for two years.

He graduated in mechanical engineering from McGill University in 1934 and then joined the Sherbrooke Machineries Limited. From 1935 to 1936 he was demonstrator in the department of mechanical engineering at McGill University and in 1936 he joined the Canadian Ingersoll-Rand Company Limited at Sherbrooke, Que. Later he worked with the Canadian Industries Limited at Brownsburg, Que.

H. T. Brunskill, M.E.I.C., is with the Ford Motor Company of Australia, Pty., Limited, at Victoria, Australia.

Mr. Brunskill has been working for more than ten years with the Ford Motor Company of Canada Limited at Windsor, Ont., as a material handling engineer.

He graduated in mechanical engineering from the University of Saskatchewan in 1940.

E. E. Copping, M.E.I.C., has been appointed superintendent of Three Rivers District, Generating and Transmission Department of the Shawinigan Water and Power Company. Mr. Copping was previously the assistant superintendent of the district.

He is a graduate of McGill University where he received a degree in electrical engineering in 1941.

R. A. Emerson, M.E.I.C., chief engineer of the Canadian Pacific Railway Company has been appointed by the municipal executive committee of Montreal to replace **R. B. Jones,** M.E.I.C., on the Board of Research on Traffic and Transportation Problems. Mr. Jones retired in 1950 from C.P.R. and recently resigned from the Board.

D. W. Finlayson, M.E.I.C., has joined the Aluminum Company of Canada at Montreal as a structural designer. Previously he was a structural engineer with the Canadian Brazilian Services Limited at Toronto, Ont.

R. C. Freyman, M.E.I.C., is with the Standard Oil Company of British Columbia at Vancouver, B.C.

In 1950 Mr. Freyman was with the Canadian Brown Steel Tank Company Limited at Brandon, Manitoba, and previously worked with the Husky Oil Refinery Limited at Lloydminster, Saskatchewan.

He graduated from the University of Saskatchewan in 1947 with a B.Sc. degree in mechanical engineering.

C. M. Brant, M.E.I.C., of the Department of Transport is with the Radio Aviation Section of the Telecommunications Division at Ottawa. In this capacity, he is concerned with international aeronautical telecommunications and radio aids to air navigation; he frequently represents Canada on telecommunication conferences of the International Civil Aviation Organization and the International Telecommunications Unit.

Before Confederation, Mr. Brant was the controller of Radio (Air) with the Civil Aviation Division of the Department of Transport at St. John's, Newfoundland. He was seconded to that Government by the United Kingdom Ministry of Civil Aviation. He first went from the Air Ministry to Newfoundland in 1937 as technical superintendent for the transatlantic base at Botwood, Nfld.

In 1947, he transferred to the R.A.F. and was stationed at Gander as signals officer and later at Bermuda, B.W.I., and at Dorval, Que. In 1946, he returned to Gander and assumed his duties as controller.

pumps

generator units

compressors

power units

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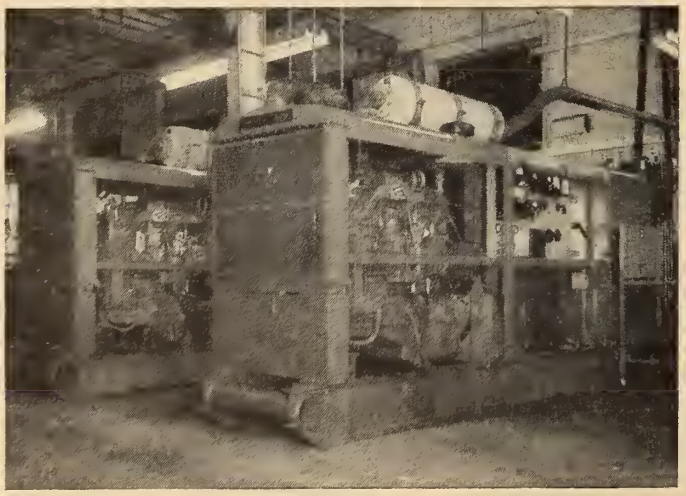

throughout Canada because they are the "custom-built" diesel . . . proven in all fields to be the ultimate in dependability and economy of operation.

Cummins diesels are assembled into power units . . . generating sets . . . marine auxiliaries . . . pumping units . . . truck and shovel replacement engines . . . at Owen Sound, Ontario. There is a complete parts and service organization to make sure every Cummins diesel is kept in first-class operating condition.

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Halifax Montreal — **OWEN SOUND** — Toronto Port Arthur

Shovels, cranes, industrial locomotives and switchers

Earthmovers, logging yarders and loaders

Off-highway trucks, crawler tractors

Work boats, pleasure craft

Buses and on-highway trucks

A. Steinbergs, M.E.I.C., has joined Atlantic Gypsum Limited at Corner Brook, Newfoundland, as a chemist.

Mr. Steinbergs was previously assistant engineer in the Department of Economic Development of the Provincial Government of Newfoundland, associated with cement and gypsum plants.

He graduated in chemical engineering from the University of Latvia in 1934.

R. Radovich, M.E.I.C., has joined Proctor, Redfern and Laughlin, consulting engineers in Toronto, as a design engineer. He had previously been working as designing engineer for L. W. Ward and Associates.

Mr. Radovich graduated from the University of Belgrade, Yugoslavia, in 1942 and received his M.A.Sc. degree from the University of Toronto in 1951.

H. W. Krushe, M.E.I.C., has been appointed plant superintendent of Western Propane Limited at Turner Valley, Alberta. He was previously working for this Company as process supervisor and technical advisor.

Mr. Krushe graduated in chemical engineering from the Polish University College in London, England, in 1947.

W. W. Davis, Jr.E.I.C.

D. L. Aker, Jr.E.I.C., is working in the electrical maintenance department of the Aluminum Company of Canada Limited at Kingston, Ont.

Previously, he was a frequency conversion engineer with McKinnon Industries Limited at St. Catharines, Ont.

Mr. Aker graduated in electrical engineering from the University of Manitoba in 1949.

K. G. Bentley, Jr. E.I.C., is a sales engineer with the Richard-Wilcox Canada Company Limited at Montreal.

He had previously been working with this company at Toronto, Ont., and earlier took a training course at London, Ont.

Mr. Bentley graduated from the University of Toronto with a B.A.Sc. degree in 1948 and worked for a time with the Ford Motor Company of Canada at Windsor, Ont.

M. G. Brown, Jr.E.I.C., is working with the Mathews Conveyer Company of Port Hope, Ont., as a design engineer.

Previously he was with the International Nickel Company in the transportation department at Copper Cliff, Ont.

Mr. Brown graduated with a B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1950.

W. W. Davis, Jr.E.I.C., has joined the sales and service staff of The Bird-Archer Company Limited as a service engineer and is taking care of the company's work in the Ottawa district.

Mr. Davis graduated in mechanical engineering from McGill University in 1950 and had been working as sales engineer with the Atlas Asbestos Company Limited, at Montreal, Que., until his recent appointment.

R. A. Fahlman, Jr.E.I.C., is regional supervisor with the Department of Fisheries at Nanaimo, B.C.; he graduated with a B.A.Sc. degree in civil engineering from the University of British Columbia in 1950.

E. W. Groves, Jr.E.I.C., is employed by the Quebec North Shore and Labrador Railway Company as a diesel supervisor at Seven Islands, Quebec.

Previously he was working with General Motors Diesel Limited at London, Ontario.

Mr. Groves graduated from the University of Manitoba in electrical engineering in 1949.

G. Gagnon, Jr.E.I.C., is working as a power plant and transmission lines engineer with the Lower St. Lawrence Power Company at Rimouski, Que.

Mr. Gagnon graduated from the Laval University with a B.A.Sc. degree in electrical engineering in 1948.

J. P. Hartt, Jr.E.I.C., is working with John Mohr and Sons at Chicago, Illinois, U.S.A., as chief field engineer and assistant superintendent.

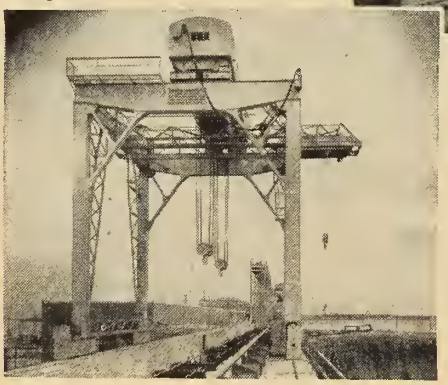
Mr. Hartt graduated with a B.A.Sc. degree in civil engineering from the University of Toronto in 1950; he was awarded the Student Membership Prize for that year.

Modern Design

AND CONSTRUCTION FOR HIGHER CRANE EFFICIENCY

These two Provincial Cranes are serving a large eastern hydro-electric generating station. To the right is shown a 200 ton overhead electric travelling crane, 61 ft. span, with auxiliary hoist of 25 tons capacity. Of all-welded construction throughout, it is equipped with magnetic braking and electric dynamic braking on both hoists. Full magnetic control is provided for all crane motions. Helical gearing in oil-tight gear cases is provided to guarantee quiet operation. Roller bearings are used throughout.

This 200-ton Crane is located in the power house adjacent to the intake deck on which the Gantry Crane (illustrated below) is located.



150 ton 6 motor electric travelling Gantry Crane on the intake deck, used for handling head gates and trash racks. A 25 ton travelling auxiliary hoist is provided.

A distinctive feature of this Gantry Crane is the provision of a twin main travel drive, a type pioneered by Provincial Engineering. 50 H.P. d.c. motors, electrically synchronized, are located on the lower crane trucks to move the crane without conventional shafts and gearing. The main crane trolley has a rail gauge of 40 ft. and carries a 150 ton twin lift hoist. The usual Provincial refinements are included — all-welded construction, roller bearings throughout, magnetic braking and electric dynamic braking on both hoists and full magnetic control.

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PROVINCIAL ENGINEERING LTD. NIAGARA FALLS, CANADA

MONTREAL • TORONTO • VANCOUVER

MANUFACTURERS OF ALL TYPES OF ELECTRIC CRANES AND HOISTS

A. C. Bunbury, JR.E.I.C., has been transferred from Cheticamp, N.S., to the Moncton office of the Federal Department of Resources and Development in New Brunswick. He had been working as resident engineer at the Cape Breton Highlands National Park.

Previously he was with the Fundy Construction Company Limited at Neil's Harbour, N.S., after graduating in civil engineering from the University of New Brunswick in 1950.

R. A. Debou, JR.E.I.C., is an assistant field project engineer with the Shell Oil Company of Canada Limited at the Shellburn Refinery, B.C.

Mr. Debou graduated in civil engineering with a B.A.Sc. degree from the University of British Columbia in 1949, and for a time worked with the Northern Construction Company and J. W. Stewart Limited at Vancouver, B.C.

R. J. Hipkin, JR.E.I.C., sales representative of the Montreal division of the Canadian Johns-Manville Company Limited, has recently graduated from an advanced course in modern sales and technical procedure. Mr. Hipkin was one of a large group from several provinces who were selected from among their fellow employees for advanced study in preparing them for greater technical assistance to customers.

The trainees made a survey of all company products in all stages and later received practical field instruction in installation techniques and actual application of the company's building and industrial products. They were instructed by senior executives of the company on such activities as finance, production, research, industrial and public relations and sales promotion.

Mr. Hipkin graduated from McGill University in chemical engineering in 1950.

During the Second World War he served for four years as a navigational officer.

R. I. Howard, JR.E.I.C., has joined the Central Mortgage and Housing Corporation at St. John's, Newfoundland.

Previously, he was assistant district engineer on Maritime Marshland Rehabilitation, with the Department of Agriculture at Moncton, New Brunswick.

Mr. Howard graduated in civil engineering from the University of New Brunswick in 1950.

A. W. Houseman, JR.E.I.C., has accepted a position in the electric accounting machine division of the International Business Machines Company Limited in Winnipeg, Manitoba. He is attending their engineering school in Endicott, New York for a period of six months.

Previously he worked as construction engineer with the Clement Riley Construction at Winnipeg.

Mr. Houseman graduated in electrical engineering from the University of Saskatchewan in 1948.

A. Hogue, JR.E.I.C., is with Defense Construction Limited at the R.C.A.F. Station at Bagotville, Que.

Previously, he was assistant city engineer at the City Hall at Hull, Que.

Mr. Hogue graduated with a B.A.Sc. degree in civil engineering from Ecole Polytechnique in 1950.

E. L. Ilson, JR.E.I.C., has joined the Canadian General Electric Company at the Montreal East Works, Que.

Previously, he was working as draughtsman and design engineer with Kearns and Bromley, consulting engineers at Montreal, Que.

C. P. Jones, JR.E.I.C., is working with John M. Read, consulting engineers, at Vancouver, B.C.

Mr. Jones graduated from the University of British Columbia in 1947 and received a degree of B.A.Sc. in 1948.

Previously he was working with Swan, Rhodes and Wooster, at Vancouver, B.C.

R. W. Kenny, JR.E.I.C., is an electrical engineer with the Ontario Paper Company at Thorold, Ont.

Mr. Kenny graduated with a B.Sc. degree in electrical engineering from the University of New Brunswick in 1950.

Y. Kato, JR.E.I.C., is with the Aluminum Company of Canada at Montreal, Que.

Mr. Kato graduated with a B.Sc. in electrical engineering from the University of Manitoba in 1945.

Previously he was working with Canadian Comstock Company Limited at Montreal. Earlier he had worked with Rankin Company Limited in Montreal and at Courtaulds in Cornwall.

J. D. Kent, JR.E.I.C., is working as office engineer with Fraser-Brace Terminal Constructors at Saint John, New Brunswick.

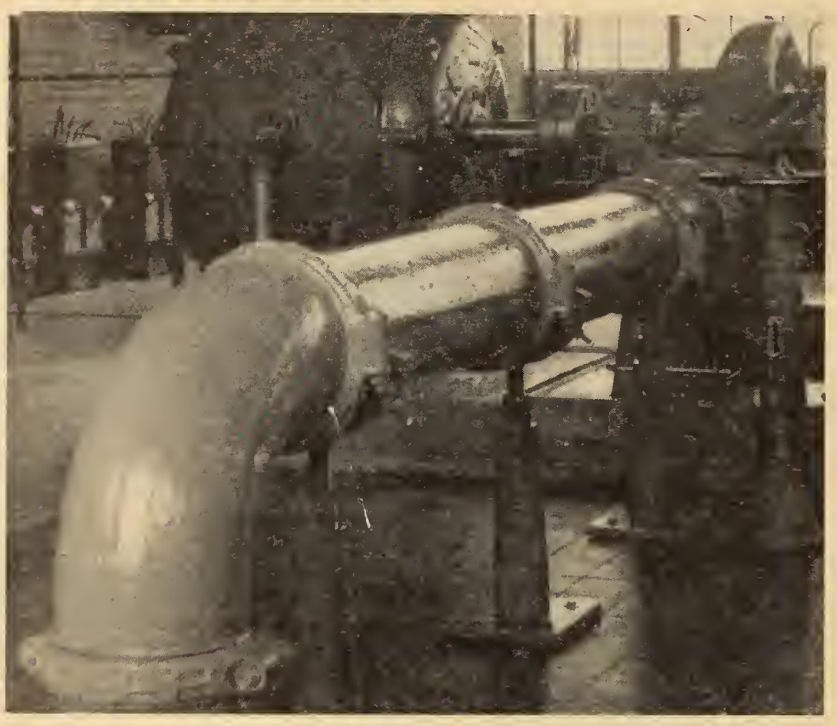
Previously, he was a draughtsman with Dominion Bridge Company Limited at Montreal, Que.

Mr. Kent graduated in civil engineering from the Nova Scotia Technical College in 1949.

E. F. O'Keefe, JR.E.I.C., has joined the Aluminum Company of Canada at Arvida, Que.

Previously, he was a chemical engineer with Price Brothers and Company Limited at Kenogami, Que.

Victaulic PIPE COUPLINGS



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Used with steel, wrought iron, cast iron and other pipes, temporary or permanent, for air, water, oil or gas service in sizes ¾" to 60".

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FLEXIBLE PIPE COUPLINGS — VICTAULIC — FULL-FLOW PIPE FITTINGS

Victaulic Company of Canada Limited — 406 Hopewell Ave., Toronto, Ontario

Mr. O'Keefe graduated in chemical engineering from the University of Toronto in 1950.

L. Loebenberg, JR.E.I.C., is an electrical engineer with Surveyer, Nenniger and Chenevert at Montreal, Que.

He had previously worked in the electrical department of Stadler, Hurter and Company at Montreal, Que.

Mr. Loebenberg graduated in electrical engineering from McGill University in 1946.

B. E. Moore, JR.E.I.C., is with William Kennedy and Sons Limited at Owen Sound, Ontario.

Previously, he was assistant superintendent with the National Table Company Limited at Owen Sound, Ont.

Mr. Moore graduated with a B.A.Sc. degree in engineering and business from the University of Toronto in 1950.

D. A. McCann, JR.E.I.C., has joined the Westinghouse Company in Hamilton, Ontario.

Previously, he was a mine engineer with the Hudson Bay Mining and Smelting Company Limited at Flin Flon, Manitoba.

Mr. McCann graduated in mechanical engineering from the University of Saskatchewan in 1950.

N. F. McPherson, JR.E.I.C., is with the Canadian-Brazilian Service Limited at Toronto, Ont.

Mr. McPherson graduated with a B.A.Sc. degree in electrical engineering from the University of Toronto in 1949.

J. L. McKelvie, JR.E.I.C., has left his position with the Sperry Gyroscope Company at Brentford, England, to take up a post as project engineer with the PSC Applied Research Limited at Toronto, Ont.

Mr. McKelvie graduated in electrical engineering from Queen's University in 1947 and worked for a time as assistant instructor at the Massachusetts Institute of Technology, U.S.A., before going to England as research engineer with the Sperry Gyroscope Company Limited.

N. W. McDermid, JR.E.I.C., has joined the Canadian Industries Limited.

Previously, he was with the Anglo-Canadian Pulp and Paper Mills, at Quebec, Que.

Mr. McDermid graduated in mechanical engineering from McGill University in 1950.

L. H. Vallee, JR.E.I.C., has been appointed manager with the British Columbia Power Commission, at Terrace, British Columbia.

Mr. Vallee graduated with a B.A.Sc degree in electrical engineering from the University of British Columbia in 1950.

C. P. Woodward, JR.E.I.C., has transferred from the Dominion Bridge Company Limited at Lachine, to Canadair Limited at Montreal, Que., as a design engineer (structures).

Mr. Woodward graduated in mechanical engineering from McGill University in 1950.

F. N. Walsh, JR.E.I.C., has been appointed Eastern Canada representative with the Plywood Manufacturer's Association of British Columbia.

He has recently returned to Ottawa from the West Coast where he underwent intensive training in all aspects of manufacture, properties and application of waterproof glue Douglas Fir Plywood.

Mr. Walsh graduated in civil engineering from McGill University in 1950, and is a member of the Corporation of Professional Engineers of the Province of Quebec.

F. De Francis, JR.E.I.C., has been appointed field representative in Quebec and the Maritimes for the Plywood Manufacturer's Association of British Columbia.

He has recently returned to Montreal from the West Coast where he underwent intensive training in all aspects of manufacture, properties and applications of waterproof glue Douglas Fir Plywood.

Mr. De Francis graduated from McGill University with a degree in civil engineering in 1951, and is a member of the Corporation of Professional Engineers of the Province of Quebec.

G. G. Tremblay, JR.E.I.C., is emloyed with G. D. Woods and Gordon.

Mr. Tremblay graduated in mechanical engineering from McGill University in 1950.

D. L. Halsal, JR.E.I.C., is working with Sylvania Electric Products at Seneca Falls, New York, U.S.A.

Mr. Halsal graduated in electrical engineering from Queen's University in 1950.

B. A. Quinlan, JR.E.I.C., is with the British Columbia International Engineering Company Limited, at Vancouver, B.C.

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Tool costs are slashed because these Deloro Stellite products all outwear from 5 to 25 hardened steel parts guaranteeing many extra months of trouble-free service . . . a major value where accuracy must be maintained.

Manufactured in Canada, popular sizes of these parts are supplied from stock; gauges and specials are produced on short notice. Write for price lists.

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Mr. Quinlan graduated with a B.A.Sc. degree in civil engineering from the University of British Columbia in 1950.

J. P. Shnier, JT.E..C., is maintenance supervisor with Canadian Resins and Chemicals at Shawinigan Falls, Que.

Mr. Shnier attended Queen's University from 1943 to 1946 and graduated from the University of Oklahoma with a degree in chemical engineering in 1947. He joined Canadian Resins and Chemicals soon after graduation and has worked as technical assistant and department head in both the Resins and Compounding Divisions prior to his recent transfer to the maintenance department.

D. R. Walsh, JT.E.I.C., is working with the Stadler, Hurter and Company, consulting engineers of Montreal, Que.

Previously he was with the Shell Oil Company of Canada at Montreal East Refinery, Montreal.

Mr. Walsh graduated in mechanical engineering from McGill University in 1950.

A. P. Earle, JT.E.I.C., has been appointed assistant to the superintendent, Three Rivers District, Generating and Transmission Department of Shawinigan Water and Power Company.

Mr. Earle joined this Company as an engineer in training in 1950 after graduating in electrical engineering from McGill University in 1949.

J. F. Zimmerman, JT.E.I.C., is resident engineer with the Central Mortgage and Housing Corporation, at Rivers, Manitoba.

Previously, he worked in the assessment department for the City of Winnipeg, Manitoba.

Mr. Zimmerman graduated from the University of Manitoba as a civil engineer in 1950.

J. W. Wale, S.E.I.C.

J. R. Finlay, S.E.I.C., is with the Dominion Bridge Company at Winnipeg, Manitoba.

Mr. Finlay graduated in mechanical engineering from the University of Manitoba in 1951.

W. Henry, S.E.I.C., is a flying officer with the R.C.A.F. at Ottawa, Ont.

Mr. Henry graduated in civil engineering from the University of British Columbia with a B.A.Sc. degree in 1951.

I. R. Hudson, S.E.I.C., is with Sandwell and Company Limited, consulting engineers at Vancouver, B.C.

Mr. Hudson graduated in mechanical engineering from the University of British Columbia with a B.A.Sc. degree in 1951.

J. W. Wale, S.E.I.C., is employed with Canadian Johns-Manville Company Limited at Montreal, Que., as special sales representative contacting selected industrial accounts at the engineering level in Montreal.

Previously, he was process engineer with the Ford Motor Company of Canada Limited at Windsor, Ont.

Mr. Wale graduated in mechanical engineering from McGill University in 1950.

N. E. Lang, S.E.I.C., is a process engineer with Noranda Copper and Brass Limited at Montreal, Que.

Mr. Lang graduated in mechanical engineering from McGill University in 1951.

J. A. G. Brown, S.E.I.C., is with the Nova Scotia Light and Power Company at Halifax, Nova Scotia.

Mr. Brown graduated in mechanical engineering from the Nova Scotia Technical College in 1951, and worked for a time with the Sumner Propane Gas Limited at the Victory Industrial Centre, Moncton, N.B.

A. G. Bouzane, S.E.I.C., is with the Anglo - Newfoundland Development Company at Grand Falls, Newfoundland.

Mr. Bouzane graduated in mechanical engineering from the Nova Scotia Technical College in 1951.

W. H. Cameron, S.E.I.C., is assistant resident engineer at Cold Lake with the Central Mortgage and Housing Corporation of Edmonton, Alberta.

Mr. Cameron graduated in civil engineering from the University of Manitoba in 1951, and has worked for the Fraser Brace Company at St. Joseph d'Alma, Que., and the Pentagon Construction Company at Parent, Que.

R. G. Canning, S.E.I.C., has left the Dominion Government and is now employed by Lockwood, Kessler and Bartlett (Canada) Limited, on the transmountain pipe line survey and location.

Mr. Canning graduated from the University of Toronto where he received a B.A.Sc. degree in civil engineering in 1951.

R. H. Reynolds, S.E.I.C., is working in the apparatus department of the Canadian General Electric Company at Toronto, Ont.

Mr. Reynolds graduated in electrical engineering from the University of Alberta in 1951.

Visitors to Headquarters

C. S. Landon, M.E.I.C., Winnipeg, Manitoba, May 13, 1952.

R. M. Richardson, M.E.I.C., Saint John, N.B., May 17, 1952.

C. S. Landon, M.E.I.C., Winnipeg, Mantoba, May 17, 1952.

C. J. Currie, M.E.I.C., Halifax, N.S., May 17, 1952.

J. S. Morehouse, Honitown, Pa., U.S.A., May 19, 1952.

E. Hartford, Yonkers, N.Y., U.S.A., May 19, 1952.

W. H. van Allen, Ottawa, Ont., May 21, 1952.

M. L. Baker, M.E.I.C., Halifax, N.S., May 22, 1952.

Obituaries

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

J. G. Macphail, M.E.I.C., former director of the marine services in the Transport Department, died at his home in Ottawa on April 23, 1952.

Born in Orwell, P.E.I. in 1877, Mr. Macphail was educated at Uigg Grammar School and Prince of Wales College at Charlottetown and graduated in civil engineering from Queen's University in 1905. After graduation, he joined the Department of Marine and Fisheries in Ottawa. For several years he was engaged on various lighthouse surveys and engineering work over a wide field. In 1908, the office of the Commissioner of Lights became vacant and he was placed in charge as acting commissioner; he was appointed commissioner in 1911. His scientific and technical training and his practical experience enabled him to take advantage of the advancement in science which commenced to transform the Lighthouse Service in 1905; there were many occasions when he undertook urgent and difficult work in the field, salvage and cable operations, particularly during World War I.

In 1936, his responsibilities were increased when the Department of Railways and Canals and the Department of Marine were amalgamated to form the Department of Transport. As chief of Aids to Navigation, his duties included the supervision of some seven harbour commissions, 300 public harbours and 2,000 Government wharves.

He was promoted to the position of director of Marine Services in 1940 and was also chairman of the Lighthouse Board of Canada. He represented the Government at international conventions on Lighthouse affairs in Canada, the United States and Europe, including those in London in 1929 and Lisbon in 1930.

In 1943, his outstanding contributions to the Government service were recognized when he was made a Companion of the Imperial Service Order; previously he received Their Majesties Silver Jubilee Medal and Their Majesties Coronation Medal. He retired from Government Service in 1946.

Mr. Macphail joined the Institute as a Student in 1904, became an Associate Member in 1910 and Member in 1922. He attained his Life Membership in 1947. He was also one of the organizers of the Professional Institute of the Civil Service of Canada.

E. J. Carlyle, M.E.I.C.

E. J. Carlyle, M.E.I.C., former executive director and secretary-treasurer of the Canadian Institute of Mining and Metallurgy, died in Victoria, B.C., on April 27, 1952.

Born at Woodstock, Ontario, in 1877, he attended schools there and graduated from McGill University in 1904. From 1907 he was smelter superintendent for Kyshtim Corporation and the Sissert Corporation in Russia. He held the same post for the Fematina Company in Argentina from 1913 to 1914; the British American Nickel Company, at Sudbury, Ont., from 1918 to 1923, and the Northern Peru Mining and Smelting Company in Peru from 1926 to 1931. He spent the rest of his working life in Canada. In 1934 he became the secretary-treasurer of the Canadian Institute of Mining and Metallurgy and 16 years later he took on the additional post of executive director. He retired in 1949.

Mr. Carlyle joined the Institute in 1939; he was a member of the American Institute of Mining and Metallurgical Engineers, the Institute of Metals and the American Society for Metals.

E. W. Bailey, superintendent of the Canada Cement Company plant at Lakefield, Ontario, died suddenly at his home on May 8, 1952.

Mr. Bailey was born in London, England. After coming to Canada, he lived in Ottawa until 1900, where he was educated at Lisgar Collegiate and Ottawa Technical School. In 1900, he went to Lakefield as superintendent of the electrical department of the Portland Cement Company. In 1910, this firm was taken over by the Canadian Cement Company and Mr. Bailey was named superintendent. He retired in 1945.

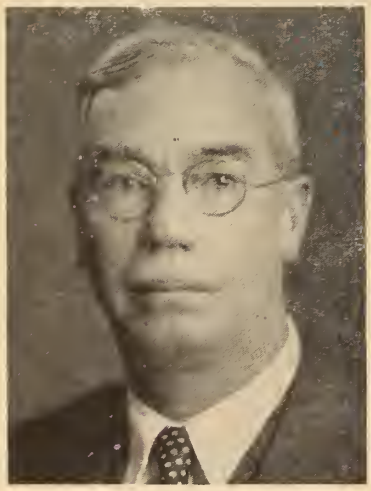
He was an affiliate of the Peterborough Branch of the Institute.

J. L. Lang, M.E.I.C., vice-president and director of the Algoma Ore Properties, died in Toronto on April 28th, 1952.

Born in Hyde, England, in 1884, Mr. Lang came to Canada in 1889; he received his early education at Parkdale Collegiate, Toronto, and graduated from the University of Toronto in 1907 with a B.A.Sc. degree. He then served in private practice at Sault Ste. Marie, first as a partner in the firm of Lang and Keys, in 1910 the firm took the name of Lang, Keys and Ross and in 1911 became Lang and Ross. For many years, he was president of Lang and Ross at Sault Ste. Marie and was associated with the building of power dams in all parts of Canada. He was also a director of the Algoma Steel Corporation and the Great Lakes Power Company.

During the First World War, he served overseas with the 242nd Battalion and held the rank of major. He was honorary lieutenant-colonel in the Sault Ste. Marie and Sudbury Regiment.

Mr. Lang joined the Institute as a Member in 1921 and was a former vice-president for Ontario. He was a past president, and a member of the Council



J. L. Lang, M.E.I.C.

of Professional Engineers Association of Ontario, a member of the University Clubs of Toronto and Montreal and a member of the Engineers Club, Toronto.

E. C. Miller, M.E.I.C., vice-president of T. Pringle and Son Limited, died at the Royal Victoria Hospital on May 2nd, 1952.

A native of Montreal, Mr. Miller joined T. Pringle and Son Limited on completion of his education in Montreal schools, and remained with the company for 47 years. He served as manager and as director of their Toronto office prior to 1934 and later as managing director in Montreal.

He was considered to be one of the outstanding authorities on industrial architecture and his services were retained by leading corporations of Canada, Great Britain, the United States, Sweden and Switzerland. His name was associated with the building of many industrial plants including The Gazette, Liquid Carbonic (Canada) Company Limited, Royal Typewriter Company, Atlas Asbestos Limited, Canadian General Electric and many other industrial buildings.

Mr. Miller joined the Institute as an Associate Member in 1921 and became a Member in 1940; he was a member of the Royal Architectural Institute of Canada.

E. C. Miller, M.E.I.C.

Victor Michie, M.E.I.C., assistant supervisor of the Central Mortgage and Housing Corporation's Prairie Region, died suddenly in Winnipeg on May 7th, 1952.

Mr. Michie was born at Balmoral, Scotland, in 1882 and was educated at Gordon's Technical College and the Surveyor's Institute at South Kensington, London, England. He then entered a pupilage with James Anderson and Company in 1899 and completed his articles in 1903. During this time he was associated with the construction of the Aberdeen Harbour and London South Western docks at Southampton.

From 1904 to 1906 he was employed with the Grand Trunk Pacific Railway, and was resident engineer with the Canadian Pacific Railways in 1907 in connection with the Pheasant Hills branch and later on the construction of the Moose Jaw Extension. He continued working with the C.P.R. on construction of various lines in charge of grading, track laying, surfacing, bridging and building until 1914 when he was on overseas service until 1916. After the War he became municipal engineer on construction of Highways in the municipality of Morton, Manitoba.

During World War II he was inspecting engineer for the Western district with the Department of Munitions and Supply and for a time was located in Newfoundland. From 1945 to 1948 he was director of construction and demolition for the Federal War Assets Corporation at Montreal and Ottawa.

Mr. Michie was Federal member of the Fraser Valley and Greater Winnipeg Dyking Boards and helped engineer construction of the Western lines for the Canadian National and Canadian Pacific Railways.

He joined the Institute as an Associate Member in 1909, became a Member in 1921 and attained his life membership in 1947. In 1941 he was chairman of the Winnipeg Branch of the Institute.

At the annual meeting of the Institute at Vancouver in May, Mr. J. B. Carswell, M.E.I.C., announced the passing of Mr. Michie with whom he had been associated for many years; he said that in the death of Mr. Michie, the engineering profession had suffered a great loss. He mentioned that he was one of the few remaining railroad location engineers with a vast knowledge of railroad construction. Mr. Michie had both practised as a consulting engineer and had been for many years in the construction business, where he was well known.

The meeting rose and observed a minute's silence in respect to the late Mr. Michie.

D. J. Kean, M.E.I.C., county engineer for County of Ontario, died on April 11, 1952.

Mr. Kean was born at Gamesbridge, Ont., in 1884 and was educated at Orillia Collegiate Institute and graduated from the University of Toronto in 1909. After graduation he worked with the Canadian National and Pacific Railways until he was made county engineer of Ontario in 1919. He also had permission from the county to practice in a private capacity. He was keenly interested in bridge design and was associated with the construction of the bridge over narrows at Orillia where the plaque bears his name.

Mr. Kean joined the Institute as an Associate Member in 1920 and became a Member in 1937.

J. Cartier, Jr.E.I.C.

Jacques Cartier, Jr.E.I.C., of Montreal, Que., died on March 22nd, 1952.

Mr. Cartier was born at L'Assomption, Que., in 1925 and was educated at L'Assomption College. Later he attended the Ecole Polytechnique where he graduated with a B.A. degree in 1949. He was first employed by the City of Longueuil and later joined the City of Montreal where he was working up to the time of his death.

Mr. Cartier joined the Institute as a Student in 1944 and became a Junior Member in 1951.

Employment Service

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

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

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

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER to work as control engineer on technical staff of new modern sulphate pulp mill. Work consists largely of special problem assignments, with a minimum of routine duties. Problems are varied in character and may include those of process development process control, economic return, development of testing procedures or other assignments of a development or mill research nature. Qualifications: preference to a recent graduate anxious to become established in pulp and paper field. Good starting salary and opportunity. Apply fully in writing stating age, university record, work history and availability. Apply to File No. 4264-V.

CHEMICAL ENGINEER who has had considerable experience in an analytical chemical lab. required to take complete charge of a moderately sized chemical laboratory and do process control, inventory control and inspection work. Location Niagara Falls. Apply to File No. 4268-V.

CIVIL

CIVIL ENGINEER for construction work on heavy industrial buildings. Applicant should be graduate engineer with experience on construction work and building layout. Apply to File No. 4263-V.

CHIEF ENGINEER required by heavy construction company with head office in Montreal. Candidates must be qualified engineers with long successful experience on major civil engineering works, with locating Canadian or U.S. contractors. Able to take full control of contracts estimate to final account. Experience on marine work an advantage. Apply to File No. 4265-V.

ESTIMATOR FOR steel fabricator in Edmonton. Experience: at least three years in taking off structural reinforcing and miscellaneous iron. State experience, salary earned and when available in first letter. Applicant enclose recent snapshot. Apply to File No. 4271-V.

ELECTRICAL

ELECTRICAL ENGINEER with several years experience in wiring diagrams, switchboards, or the layout of generating stations is required for the Toronto design office of a large private firm. Prefer applicant with an A.M.I.E.E. and in the age range of 25 to 32. Ability to write concise and lucid technical reports is important. Company offers a pension plan, group insurance, blue cross and other benefits. Quote file number 15055. Apply to File No. 4262-V.

ASSISTANT PROFESSOR of electrical engineering required by university located in the Maritimes. Teaching two or more specified subjects within the field of electrical engineering including laboratory instruction, member of faculty and other duties as assigned. Graduate of a university with one or more years post graduate training in an accepted industrial graduate engineers training programme or equivalent experience. Apply to File No. 4269-V.

ELECTRICAL ENGINEER with one or two years experience in the electrical manufactures of diesel electrical equipment. The work involved would cover both practical and theoretical sides and considerable detail with respect to prints, assemblies, materials and device manufacture. Location Ontario. Apply to File No. 4270-V.

MECHANICAL

MECHANICAL ENGINEER 1950 graduate who would be interested in doing development and design work on equipment both large and small for use in the explication of radioactive materials to industrial, medical, and research purposes. Location Ontario. Apply to File No. 4260-V.

MECHANICAL SUPERINTENDENT required by new plant in Ontario, American owned manufacturer of a complete line of centrifugal pumps. Applicant should be a Canadian citizen 35 to 45 years of age preferably married. He should also have a good working knowledge of production planning and scheduling. Salary open. Apply to File No. 4261-V.

MECHANICAL ENGINEER, with knowledge of mechanical design and considerable experience in the maintenance of steam and diesel engines and ammonia refrigerating equipment. Preferably bilingual. Applicants should state age, experience and salary expected. Salary open depending on experience. Apply to File No. 4279-V.

GRADUATE ENGINEER, preferably Mechanical Engineering with 8 years or more of engineering and production experience in industry. Age range 30-40 years. Duties will be to activate and co-ordinate a programme for the improvement of manufacturing methods and facilities for several plants with the purpose of obtaining the most effective and economical operation. This will include improved operating methods, equipment, materials handling, plant layout and wage incentive, instalaltions. Starting salary range is $7,400-$8,700 although it could be higher if the right man is found. There is a good opportunity for advancement. Apply to File No. 4280-V.

GRADUATE ENGINEERS, preferably mechanical engineering with 3 or more years of industrial engineering experience in indsutry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment, materials handling, plant layout, and other aspects of factory operation. He will also make time studies to establish production standards for wage incentive installations. The starting salary range is $3,750-$4,300. There are good opportunities for advancement. Apply to File No. 4280-V.

MISCELLANEOUS

ASSISTANT CHIEF ENGINEER required by large and progressive company manufacturing pulp and paper products, offers excellent opportunity for assistant chief engineer. Will be located in Ontario, work includes development design construction and maintenance on multiple plant basis requiring extensive experience. Salary in line with responsibility. Reply in confidence to File No. 4259-V.

SOILS ENGINEERS experienced in soil mechanics and foundations engineering, are required by a rapidly expanding organization. Graduate soils work desirable. Location Montreal, but some travelling required. Salary open. Apply to File No. 4266-V.

TECHNICAL SALESMEN reqiured to act as company representatives in an area or product specialist with specified customers. Selling experience is preferred. Locations Montreal and Toronto. Apply to File No. 4267-V.

GRADUATE ENGINEERS 1951 or 1952 to act as liaison between customer and production. No experience is necessary however man must have definite ability and aptitude to sell. Locations Montreal and Toronto. Apply to File No. 4267-V.

CHIEF ENGINEER to take full and immediate charge of industrial office in Toronto. Applicant must possess excellent background in tools, jigs, dies, and special machine designing and must possess qualifications of directing approximately 50 men and maintaining client relationship. Highest salary for like position in Canada, with a future unlimited. Apply to File No. 4272-V.

FIELD AND OFFICE ENGINEERS urgently required in connection with large construction programme in Eastern Canada. Excellent salaries. Write at once giving full background including present salary and salary expected. Apply to File No. 4273-V.

SALES ENGINEER required for permanent position by manufacturer in Quebec City. Salary, commission and expenses. Preferably French Canadian who is bilingual. Apply to File No. 4274-V.

CONSTRUCTION ASSISTANT personnel manager required by company undertaking major construction programme in Eastern Canada. Under personnel manager directs entire personnel programme, including selection and processing of personnel, but is particularly charged with administrative functions such as establishment of procedures, classifications, and rates; review of promotions, problems covering employment agreements, leave, and pay. Qualifications: construction and personnel experience. Definite administrative ability. Salary open. Location St. John, N.B. Apply to File No. 4275-V.

TECHNICAL SALES ENGINEER, recent chemical, civil or mining graduate required by Montreal firm in chemical construction and process engineering field. Job involves some travelling, designing, estimating and supervising work. Good opportunity for advancement to responsible positions. Apply to File No. 4276-V.

YOUNG GRADUATE ENGINEER required by financial institution to make surveys of and write reports on industrial plants in the province of Quebec. Must be completely bilingual and preferably with some manufacturing experience. Permanent position, pension and insurance benefits. Salary according to qualifications. Apply to File. No. 4277-V.

CONSTRUCTION AND EQUIPMENT installation supervisor for newsprint mill to be erected in India. Applicant should have an engineering background and experience in mill construction and maintenance work and a working knowledge of mill operations from the process end will be helpful. Salary $12,000 per annum. Apply to File No. 4281V.

METALLURGIST required by large organization in Montreal. Applicant will act as consultant for all materials used. Apply to File No. 4282-V.

ENGINEER REQUIRED by large organization in Montreal well versed in welding operations. Apply to File No. 4282-V.

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

CHEMICAL

CHEMICAL ENGINEER or practical chemist required by American organization to establish headquarters in Windsor, Ontario, and travel in Canada. Initial assignment would be plan and help implement a sales program in the metal treating chemicals field. Applicant must be sales minded and preferably with experience in chemical sales. He should be between 30 to 40 years of age and be a Canadian citizen. Of prime importance he must be able to work with present personnel gracefully and gradually assume a position of leadership. He must be of executive calibre and proven ability. Apply to File No. 4205-V.

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

CHEMICAL ENGINEER for development and control work in a pulp and paper mill located in Province of Quebec. Good starting salary, excellent opportunities. Apply in detail. Apply to File No. 4222-V.

CHEMICAL ENGINEER, recent graduate required for technical work in sales department of well established Toronto manufacturer. Apply to File No. 4223-V.

CHEMICAL ENGINEER required with intimate experience in the field of biochemistry and allied processes. Man needed for this position must be capable of giving independent direction on various projects under way. Should have no objection for overseas duties. Present staff have been informed. Apply to File No. 4230-V.

CIVIL

CITY ENGINEER required by large city in Western Canada to act as administrative head of the City Engineering Department to promote, plan, coordinate and direct the executive of all municipal engineering projects. University graduate in Civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or an equivalent combination of training and experience. Apply to File No. 4227-V.

ASSISTANT HYDRAULIC ENGINEERS for water rights branch, Department of Lands, Victoria, B.C. Salary $283.00 to $338.00 per month. Graduates in engineering, preferably civil; eligible for registration as engineer-in-training in B.C., Professional Engineers' Association. Photo-grammetry, hydraulics and hydrology of river discharge, some knowledge of dam design, soil mechanics and soil sampling, preferably some experience on engineering work in hydro-electric irrigation or hydrology fields. Positions permanent. Superannuation plan. Promotion to hydraulic engineer, maximum salary $413.00 on completion of full professional registration. British subjects, under 45 years unless ex-servicemen. Apply to File No. 4228-V.

CIVIL ENGINEER required by large organization in Toronto. Recent graduate with experience in reinforced-concrete design for layout of hydro structures. Would consider senior draughtsman. Apply to File No. 4239-V.

CIVIL ENGINEER required by established company. Preferably with some experience in hydrology, for field and office investigations in the Province of Quebec. Apply to File No. 4243-V.

ELECTRICAL

ELECTRICAL ENGINEER with communications option or graduation in physics required in Montreal. Previous experience with air force electronics work desirable but not essential. Should be able to write and interpret specifications and be office type as this is altogether desk work. Salary open. Apply to File No. 4210-V.

ENGINEER REQUIRED by electrical manufacturer in Toronto to engineer, produce and sell electrical connectors. Apply to File No. 4229-V.

ELECTRICAL ENGINEER to act as sales engineer for manufacturer located in Toronto of electrical and power house equipment. Some experience desirable and free to travel. Company car supplied. Apply to File No. 4229-V.

PROFESSIONAL ENGINEER with good electrical background and adequate experience to manage and plan maintenance and extensions to Hydro, gas and water utilities systems in a town in South Western Ontario with a population of 8,000. Very favourable living conditions. Salary in accordance with experience but in the range of $5,500.00 to $6,500.00 for the type of man desired. Apply giving age, education and brief outline of past experience. Apply to File No. 4238-V.

ELECTRICAL ENGINEER RECENT graduate for foreign service of large Canadian company to undergo development in preparation for a specific engineering assignment. To undergo 3 months training period in Toronto. Prefer single men. Apply to File No. 4239-V.

YOUNG ELECTRICAL ENGINEER required who is interested in sales in the power and electronic fields. Applicant would be stationed in Ottawa, and would cover territory extending from Cornwall to Kingston, Pembroke, and all Northern Ontario and Quebec Mining areas. Apply to File No. 4242-V.

ELECTRICAL SALES ENGINEER required for Southern Ontario area with knowledge of motor design and application. Apply stating experience and salary requirements. Apply to File No. 4254-V.

MECHANICAL

MECHANICAL ENGINEERS for process and or mechanical engineering work required by large pulp and paper mill. Single men preferred who have experience in the paper industry although experience is not absolutely necessary. Apply to File No. 4218-V.

MECHANICAL ENGINEER PREFERABLY a recent graduate, required by well established Toronto manufacturer for factory engineering department. Apply to File No. 4223-V.

MECHANICAL ENGINEER required for foreign operation of large Canadian company to act as assistant chief of power plant and station division, supervising operation and maintenance of large hydro-electric plants having reaction turbines. Prefer 8 years similar experience. Apply to File No. 4239-V.

MECHANICAL ENGINEER required in Ontario to design diesel power applications, study specifications and prepare estimates for industrial and marine power plants, pumping stations and diesel generator sets. Able to make up detailed instructions for shop fabrication of assemblies and to assist sales men on calls requiring technical information. Prefer a man about 40 years of age with ten years experience in some heavy industry such as mining or construction work. Marine engine or shipyard experience valuable. Extensive training on General Motors diesel engines of all sizes will be provided. Apply to File No. 4240-V.

MECHANICAL DESIGN ENGINEER required by paper converting company located in Southern Ontario. The work consists of machine designing, plant layout, and maintenance engineering. Qualifications should be a degree in engineering with a natural talent for designing mechanical devices. Apply to File No. 4241-V.

MECHANICAL ENGINEER recent graduate, bilingual, required, interested in engineering sales. Equipment consists of industrial pumping centrifugal, reciprocating, rotary, conventional deep well turbine pumps, etc. The work will entail the promotion of these lines with consulting engineers and industrial and municipal accounts throughout the

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PRODUCTION MANAGER

NEWFOUNDLAND HARDWOODS LIMITED
ST. JOHN'S, NFLD.

General Business and Production Manager required to take complete charge of a large modern plant manufacturing plywood, flush doors and hardwood flooring. This is a senior position with salary in line with experience and responsibility. Reply in confidence giving full details. File 4286-V.

Large petroleum marketing company in Eastern Canada requires the services of an experienced engineer to carry on research leading to producing and refining. Excellent opportunity for capable person. Replies in strictest confidence. Apply to File No. 4278-V.

Canadair
LIMITED

REQUIRES

ENGINEERS

DESIGN ENGINEERS
AERODYNAMICISTS
STRESS ANALYSTS
DYNAMICS ENGINEERS
SENIOR DRAFTSMEN
WEIGHT ANALYSTS

Positions are available for experienced aeronautical engineers and draftsmen for employment on long term design and development projects.

Excellent opportunities for advancement in a rapidly expanding organization.

FIVE DAY WEEK
PAID OVERTIME
GROUP INSURANCE BENEFITS
SEMI-ANNUAL SALARY REVIEWS

Write giving résumé of education and experience to

Canadair
LIMITED

P.O. Box 6087 **Montreal, Que.**

Canadair
LIMITED

REQUIRES

SENIOR FLIGHT TEST ENGINEER

This is a permanent position involving aerodynamic flight testing on conventional and jet-propelled aircraft.

A minimum of four years of aircraft experience is required, including two years of flight test work. Detailed knowledge of flight test methods and instrumentation, and some supervisory experience is essential.

Excellent opportunities for advancement in a rapidly expanding organization.

FIVE DAY WEEK
PAID OVERTIME
GROUP INSURANCE BENEFITS
SEMI-ANNUAL SALARY REVIEWS

Write giving résumé of education and experience to

Canadair
LIMITED

P.O. Box 6087 **Montreal, P.Q.**

City Engineer Required by City of Calgary

DUTIES

As administrative head of the city Engineering Department to promote, plan, co-ordinate and direct the execution of all municipal engineering projects including the construction and maintenance of bridges, underpasses, streets, roads and sidewalks; the development, maintenance and operation of sewers, sewage disposal plants, garbage collection and disposal system; traffic control; and the building inspection program. To prepare estimates and budgets and report on departmental activities. Applicants should advise concerning experience in supervision of water works treatment and distribution system.

QUALIFICATIONS

University graduation in civil engineering with extensive experience in varied municipal engineering work including considerable administrative responsibility and successful public relations experience; or and equivalent combination of training and experience.

APPLICATIONS

To be made in writing to Personnel Director, City Hall, Calgary, Alberta, stating salary required.

province of Quebec, with headquarters in Montreal. Remuneration will be on a salary plus commission basis. Apply to File No. 4244-V.

MISCELLANEOUS

YOUNG CIVIL OR MECHANICAL engineer required by pulp and paper company in Quebec. Applicants should be fluent in either French or English and able to make himself understood in either. Apply to File No. 4195-V.

SALES ENGINEER for Toronto office of large railway supply organization. Practical mechanical ability an asset. Railway experience preferred but not absolutely necessary. Excellent opportunity for young aggressive man. Pension plan, automobile, etc. Write giving details and including photograph to File No. 4202-V.

TECHNICAL EDITOR required by rapidly growing research organization (both fundamental and applied). First class man to advise in the initial draughting, and carry out final processing, of scientific and technical communications. This man must be capable of working with project supervisors toward the clear and accurate expression of research concepts and results. A science degree and published research, plus some writing experience are therefore essential, academic and industrial experience are both desirable. Salary commensurate with qualifications, permanent position, central location in Montreal. Reply giving full resume of career to File No. 4203-V.

ASSISTANT AGRICULTURAL engineer for research and teaching of rural electrification in the agricultural engineering department of an eastern Canadian agricultural college. Bachelor of Science in agricultural engineering or electrical engineering with master's degree relative to subject of rural electrification. Good opportunities for development work and promotion. Salary based on training and experience. Apply to File No. 4206-V.

ASSISTANT ENGINEER for research and teaching of farm machinery in the agricultural engineering department of an Eastern Canadian college. Research will include field experimental work on tillage and harvesting machinery primarily. B.S. degree in agricultural engineering or equivalent with M.S. degree with major emphasis on farm machinery. Farm background and good cooperation with initiative and willingness to work essential. Good opportunity for growth and promotion. Salary open depending on training and experience. Apply to File No. 4206-V.

ENGINEERS REQUIRED by large industry in Ontario in aircraft wing plant; process engineers, training supervisor. Maintenance department; mechanical engineers and construction design engineers. Industrial engineering, materials handling engineers and tool and die designers. Apply to File No. 4212-V.

LUBRICATION ENGINEER required in a large Eastern Canadian paper mill. Applicants should state age, experience, marital status as well as other relative information. Apply to File No. 4217-V.

ENGINEER to take charge of lecture and laboratory work in industrial electronics and servo mechanisms at a university in Eastern Canada, commencing September, 1952. Rank and salary dependent on qualifications. Apply to File No. 4219-V.

TRANSFORMER DESIGN ENGINEER required by well established organization in Ontario. Real opportunity offered in an expanding organization for a progressive engineer. Five years distribution transformer experiene desirable, but not essential, for the man possessing other suitable qualifications. Reply should include general personal data, detailed experiene record, with specific regard to types of transformers designed and recent photo. Apply to File No. 4220-V.

CITY IN ONTARIO is organizing a planning department and asks for applications for the position of Planner. Work includes revision and consolidation of the zoning by-laws, screening subdivisions, major street system, and school building programme. Experience in planning is desirable but not necessary. Applicants must be university graduates with a definite interest in planning, and preference will be given to training in engineerig. Please state salary. Apply to File No. 4231.V-

SALES ENGINEER required by well known manufacturer of product used in Canadian Pulp and Paper industry has opening for sales man in the thirties, preferably with background in paper manufacturing or sales and with technical education. Unusual opportunity for right man. Would have several months training in our own plant and in the field. Apply to File No. 4224-V.

ENGINEERS in training B.C. Forest Service. Salary $258-$308 per month. Graduate in civil or forest engineering, registered as engineer in training with Association of Professional Engineers of B.C. Promotional opportunities, positions permanent, superannuation plan. British subjects, not over 45, except ex-service men given preference. Apply to File No. 4228-V.

SEVERAL ENGINEERS with ability and initiative wanted as soon as possible, for young company; will eventually become a partner if satisfactory. Specializing in sewers, waterworks, and roadwork. When applying, please state age, graduation, references, salary expected, and full particulars, to File No. 4232-V.

MECHANICAL OR CHEMICAL ENGINEER with a minimum of one year's experience in the mechanical or chemical engineering branches. The position to fill is that of sales engineer and field representative. Considerable travelling will be involved in all parts of Ontario and Quebec, and occasionally in other provinces and the U.S. The work will involve following up inquiries, preparing and submitting quotations, assisting customers in engineering design, and negotiating engineering details of orders and contracts. The base of operations will be from Head Office in Ontario. Apply to File No. 4234-V.

JUNIOR ELECTRONICS ENGINEER for work on HF Transmitter. Location Montreal. Apply to File No. 4235-V.

PROFESSIONAL ENGINEER required by public utility in Maritime Province, to act as assistant superintendent of steam generating station. Experience required in operation of pulverized fuel fired boilers, and steam turbines in 20 to 30 thousand kilowatt range, 600 p.s.i.g., 815 degree steam conditions. Two machines now in operation, and two on order for operation in 1953 and 1955 to meet rapidly growing load. Apply to File No. 4237-V.

TECHNICAL ASSISTANT required for foreign operation of large Canadian company to supervise gas-main construction, maintenance of mains and regulators, compressors, balancing of gas pressures market surveys and load forecasting. Prefer Higher Certificate in gas engineering (supply). Apply to File No. 4239-V.

CHEMICAL OR MECHANICAL ENGINEER recent graduate required by rubber company in Ontario. He will be given thorough training and experience on production problems related to compounding and technical control. With experience this man should be able to demonstrate leadership qualities and become eligible for supervisory and managerial positions as required. Apply to File No. 4248-V.

SENIOR CONSTRUCTION administrative assistants to assist senior construction executives in administration of large construction programme in Eastern Canada. Executive ability and thorough knowledge of construction procedures required. We also need construction office managers to take charge of isolated construction offices including payrolls, inventories, personnel records, construction reports, etc. Previous experience in complete charge of construction office required. Salaries open, excellent opportunities. Apply to File No. 4249-V.

SENIOR STRUCTURAL STEEL designer required by Montreal office of consulting firm. Salary open. Apply to File No. 4250-V.

THE CIVIL SERVICE COMMISSION is assisting in the recruitment of a number of communications engineers, radio engineers, telephone and telegraph engineers and submarine cable engineers for appointment to civilian posts for foreign service. Apply to File No. 4252-V.

ELECTRICAL OR MECHANICAL ENGINEER required in Ontario for industrial cycle conversion programme. Apply to File No. 4253-V.

SALES ENGINEER FOR CENTRAL ONTARIO. Knowledge of woodworking, metal working, pulp and paper making machinery. Apply to File No. 4255-V.

YOUNG GRADUATE ENGINEER with diesel experience reqiured by organization in Ontario for expanding production programme. Also require engineer with some knowledge of diesel engine construction. Apply to File No. 4257-V.

Situations Wanted

MECHANICAL, M.E.I.C., 7 years experience in production, research and development, design, testing, tool design of gasoline and diesel engines and small mechanisms for mass production. Available on month's notice. Western Canada preferred. Apply to File No. 83-W.

ENGINEERING ASSISTANT to manager or president with 14 years of industrial experience and shop practice in mechanical, aeronautical and civil engineering. Experience includes welding, internal combustion engines, jet propulsion, nucleonics, skilled in mathematics and physics, has personality and know how experience. Bilingual, 40 years old, married; M.E.I.C., M.A.S.M.E.; P.Eng. University Graduate. Apply to File No. 140-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc., (Queen's, 1948), desires foreign employment in construction field. Four years experience on the location, construction and maintenance of highways and railroads both as engineer and foreman. Presently employed as resident engineer by contractors in railroad construction. Age 26, single. Apply to File No. 204-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., middle thirties, married, veteran, eight years diverse experience; control laboratory chemist, inspection, installation, production, development, and research. Presently employed on practical research problems in corrosion and heat transfer. Apply to File No. 297-W.

CIVIL ENGINEER, M.E.I.C., University graduate, 22 years experiene abroad and in British Government service in: layout design, field supervision of railways, roads, buildings, water supply, drainage, soil mechanics, erosion control, countour survey, mapping, triangulation. 3 years in Canada as chief of survey-parties, resident engineer on National Defence Work, factory construction, railway, road location survey, lines and grades, estate survey, quantity take-off, re-inforced concrete foundations. Married, bilingual, veteran C.R.E., desires progressive position as chief of survey or assistant to senior executive where experience may be utilized combined with aptitude for organization. Suitable recommendations from employers available. Apply to File No. 489-W.

CHEMICAL ENGINEER, McGill University, 1950. Presently employed in U.S. doing design and production work. Would like to return to Western Canada. Desires position in production and process. Apply to File No. 1467-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Ontario, 1945, married, 3 children, desires responsible and supervisory position preferably in the plant engineering field. Has broad experience in construction, machine design and layout, maintenance and supervision. Prefers a location in Southern Ontario. Apply to File No. 1997-W.

ENGINEER MECHANICAL, interested in position offering opportunity as representative, plant or assistant engineer. Experience includes twelve years design, construction and maintenance with pulp and paper industry. Age 40, married. Apply to File No. 2642-W.

CHEMICAL ENGINEER, M.E.I.C., McGill, age 32, married. Business administration training. Experience includes: management, supervision, sales, production, research, development and control. Synthetic resins, protective coatings, building products, fermentation, detergents, acids, explosives. Organic and inorganic chemistry. Bilingual. Presently employed. Apply to File No. 2850-W.

MECHANICAL ENGINEER, graduated 1947. Four and one half years experiene in maintenance, installation and production. Desires production work with small Montreal manufacturing firm. Apply to File No. 3208-W.

CIVIL ENGINEER, Jr.E.I.C., age 27, married, one child, desires position with responsibility, in sales promotion, and/or sales and design with a well established ompany. Five years varied structural engineering experience in wood, concrete and steel construction. Prairie Provinces or Ontario preferred. Apply to File No. 3340-W.

MECHANICAL ENGINEER, McGill, 1940, M.E.I.C., P.Eng., Quebec. Presently employed in an exeutive capacity seeks senior position with progressive firm. Experience includes maintenance, plant layout, machineshop, manufacturing, administration and five years as works manager of large engineering plant. References. Apply to File No. 3355-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., A.M.I.C.E., P.Eng. Age 40, with considerable experience since 1933 (including England, Canada and U.S.A.) in the design of reinforced concrete and steel structures (warehouses, factory buildings, power station, boiler houses, oil refinery plants, coal hoppers and bunkers, gas-plants, apartment buildings, schools, hospitals, steel mills, chemical plants, supersonic test building and other industrial buildings, bridges), river engineering waterworks; also estimating and surveying. Seeks responsible position in Ontario or Quebec. Apply to File No. 3369-W.

ENGINEER, EXECUTIVE, M.E.I.C., B.Eng., (Que.), 25 years varied experience, administration, planning and direction of design and construction, dams, earthwork, runways, roads and streets, waterworks, sewers, sewage plants, buildings, power plants. Initiative and ability to organize effectively. Good knowledge of accounting and legal aspects of construction. Desires partnership in consulting firm or opportunity in construction business where experience will be of value. Apply to File No. 3511-W.

CIVIL ENGINEER, speializing in steel construction. 15 years experience design and construction of mill buildings, industrial and chemical plants, foundations, etc. Some experience of reinforced concrete design also. Past 3½ years senior design engineer with large Hydro-electric utility, designing power plant structures, pipe lines and penstocks, switching stations and foundations. Member E.I.C., A.S.C.E., etc. Apply to File No. 3702-W.

MECHANICAL ENGINEER, S.E.I.C., Manitoba, 1951, 5 years apprenticeship in the railway industry, 2½ years mechanic in the R.C.A.F., age 28, single. Desires position in the Industrial Engineering field offering the opportunity for training and advancement. At present working on research problems in the railway mechanical field. Ontario or Western Canada preferred. Apply to File No. 3852-W.

MECHANICAL ENGINEER, M.E.I.C., widely experienced in design of material handling equipment, cranes, crane runways and structural steel, willing to take short term contract with any firm planning a material handling system for their own plant. Will undertake design, field work, estimating and installation. Apply to File No. 3872-W.

CHEMICAL AND METALLURGICAL ENGINEER, M.A.Sc., Jr.E.I.C., U. of Montreal, 1947-1948, married, bilingual, with research and development experience in heavy chemicals, plant design and installation. At present employed with the Govt. of Canada in the chemical treatment of radioactive ores. Has gained experience in the electrochemical field and has supervised field installation of large chemical and metallurgical plant. Desires greater responsibilities in research or production within the expanding Canadian industry. Apply to File No. 3873-W.

BRITISH ENGINEER, 35, married, B.Sc., A.M.I.M.E., P.Eng. (mechanical and industrial), worked as: research, development, consulting engineer, experience: combustion, heat exchangers, fuels, refractories, instruments, furnaces, mechanical handling, welding, machine design, plan lay-out, cost evaluation; proved administrative and organizing ability, desires responsible position. Available at one month notice. File No. 3885-W.

SALES ENGINEER, Jr.E.I.C., P.Eng., B.Sc., from M.I.T. in 1951 in chemical engineering. Engineering education includes business and economics, experience includes industrial and mechanical sales to the expanding construction and chemical industries. Desire chemical or mechanical sales position with opportunity and future. Presently located in Montreal but willing to travel. Apply to File No. 3886-W.

CIVIL ENGINEER, B.A.Sc., M.S.E., M.E.I.C., R.P.E., desires position as City Engineer or City Commissioner. Is twenty-nine years old, member of Provincial Board of Health, Member of Technical Committee Revising National Building Code, a Director of Division of Sanitary Engineering, a Director of Western Water and Sewage Conference, and a Lecturer at University. Wide experience in design and financing of municipal utilities. Proven ability in Public Relations. Initiative shown by recent technical publications, school for municipal engineers and foremen, reduction of municipal fire insurance rates, activity in community planning, etc. Will not be available for service until August 1952, at earliest, but can make arrangements to visit city and discuss position beforehand. For further particulars apply to File No. 3892-W.

GRADUATE ELECTRICAL ENGINEER, M.E.I.C., P.Eng., also graduate of the General Electric Test Course experienced with Public Utility problems, especially administration, operation and maintenance and preliminary design of Hydro Electric developments. Would consider any position leading to increased responsibility. For further informtion apply to File No. 3893-W.

CIVIL ENGINEER and Land Surveyor, M.E.I.C., B.Sc., (Manitoba, 1945) M.L.S., (1947), age 28, seven years experience in higher surveying, base line and township outlines, special surveys, subdivision surveys, checking plans of survey. Desires position in survey or city planning office or engineering office involving knowledge of higher mathematics and legal descriptions. Available on one month's notice. Apply to File No. 3894-W.

CHEMICAL ENGINEER, 1951 graduate, 31, single. Sixteen months research in wood chemistry, one year production control and technical service on phenalic and area synthetic resins. Desire position with organization with a good training plan, or as an assistant to an experienced engineer. Apply to File No. 3895-W.

MINING ENGINEER, B.Sc., Jr.E.I.C., three years of experience. Presently employed. Desires position in mining in the Province of Quebec. Apply to File No. 3896-W.

CHEMICAL ENGINEER, University of Alberta, 1949 graduate, war veteran, married, 36 years old. Employed since graduation as assistant to chemical engineer supervising operation of large municipal water treatment plant employing cold process lime soda softening and boiler water treatment in allied 60,000 K.W.H. high pressure power plant. Available on two months notice. Apply to File No. 3897-W.

TWO MECHANICAL ENGINEERS, S.E.I.C., desire part time work, evenings and weekends. Estimating, designing, drafting. Apply to File No. 3898-W.

MECHANICAL ENGINEER, M.E.I.C., age 37, married, 3 children. Experience in production and maintenance of mechanical equipment and also sales and service of automatic controls. Speaks and writes both fluently French and English. Presently has own company. Desires responsible position as assistant to senior executive, requiring methodical thinking and the ability to get on well with those above and below him. Would also consider sales engineering offer. Apply to File No. 3899-W.

GRADUATE MECHANICAL ENGINEER, M.E.I.C., desires part time employment in Montreal for evenings and weekends. Detail design, draughting, tracing. Experience, maintenance of diesel engines, detail design and draughting in centrifugal pumps, tracing of piping layouts and power plant installations. Apply to File No. 3900-W.

MECHANICAL ENGINEER, M.E.I.C., age 33, married. Graduated 1948 (Germany). Experience: expert labour certificate in engine building; 7 years maintenance and supervision of ship's diesel engines (30-900 H.P.); 2 years plant layout, time and motion study, production planning; 1 year detail design and draughting on centrifugal pumps. Presently, since March, 1951, employed by Centrifugal

pump manufacturing firm. Desires more progressive position in Montreal. Apply to File No. 3900-W.

ELECTRICAL ENGINEER, Jr.E.I.C., P.Eng. (Ont.), B.Sc. (Dal. '40), B.E. (N.S.T.C. '43). Business correspondence course, age 36, married one child. Interested in maintenance and distribution with utility or medium size company with an opportunity to work into administration position. Experience includes four summers dockyard expanding electrical system, one summer Arvida construction, test course, three years consulting firm—heating, lighting, electrical and plant layouts and cost systems, four years hospital and X-Ray maintenance in China. Available immediately. Apply to File No. 3901-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950, University of Saskatchewan graduate. Married, veteran, age 27, one year of industrial design and draughting experience. Presently employed in Eastern Canada but interested in mechanical engineering openings in the province of Alberta. Available on short notice. Apply to File No. 3902-W.

MECHANICAL ENGINEER, S.E.I.C., (N.S.T.C. '51), age 23, single. Employed four summers while undergraduate with manufactured gas company. Since graduation have been employed with a small prepane bulk plant. Desire change of work, will consider anything. Available on short notice, no location preference. Apply to File No. 3903-W.

MECHANICAL ENGINEER, University of B.C., 1948, wishes to relocate in or near Vancouver. Four years experience in design, layout, and installation of light and heavy machinery; production problems; and development engineering. Will be available for interview in Vancouver late June. Apply to File No. 3904-W.

ENGLISH CHARTERED CIVIL ENGINEER, A.M.I.C.E., age 43 years. Married, one child, at present chief assistant engineer to county surveyor in England, seeks similar appointment in Canada with Provincial or Municipal authority. Wide experience in surveying, design, construction and maintenance of: steel and reinforced bridges and structures; highways, general civil and municipal engineering and administration. Five years commissioned service with Royal Engineers in U.K., India and Burma. Apply to File No. 3905-W.

LANDSURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of land-surveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. Apply to File No. 3908-W.

CIVIL ENGINEER, 1933 graduate, married, with car, 19 years experience (about a year in Canada) on design, erection and maintenance of mill buildings, chemical plants, apartment buildings, hospitals, highways, etc. Desire position in construction or work closely allied thereto. Presently employed will be prepared any time after June 15th. Apply to File No. 3920-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M.I.E.E., age 29, married, recently arrived from England and presently employed in the Maritimes. Experience: 5 years trade apprenticeship on dock and harbour installations, 4 years D.O. work including layout and estimating power and lighting projects, 4 years full time lecturer, 1 year sales and contracts with large manufacturer, and 1 year supervising maintenance of amplidyne controlled diesel-electric plant. Seeking position as a senior assistant with prospects of advancement in developing industrial or municipal undertaking. Apply to File No. 3922-W.

INDUSTRIAL AND MANAGEMENT ENGINEER, B.A.Sc., U. of M., M.E.I.C., age 35, married, bilingual, thoroughly experienced in all phasis of industrial and commercial organization and management. Background includes highly successful consulting work in a large number of companies. Desire responsible position with medium firm located preferably in Montreal. Apply to File No. 3923-W.

JUNIOR EXECUTIVE, age 31, married. Bachelor of Arts and Bachelor of Applied Science degree in civil engineering. Practical experience in surveying road and railroad construction, timber, bridge and wharf design and construction. Very familiar with construction and logging methods and machinery. At present employed by British Columbia logging company in supervisory position in charge of a logging operation. Would take position with a company with openings in technical sales or as assistant to management. Able to take responsibility of a position requiring organizing and administrative experience and ability. Apply to File No. 3924-W.

PROFESSIONAL ELECTRICAL ENGINEER, 40 years, British, seeks position in Canada. Toronto or Southern Ontario preferred. Higher and ordinary National Diplomas in Electrical engineering, with distinctions. Corporate member of The Institution of Electrical Engineers. 9 years as draughtsman, 12 years as executive engineer with electricity supply authorities on distribution and commercial activities. 3 years with British Air Ministry (Seconded). Apply to File No. 3925-W.

CIVIL ENGINEER, University of Saskatchewan, 1951, Jr.I.E.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

CIVIL ENGINEER, age 27, recent immigrant, 1st class honours, B.E. degree, National University of Ireland (1950), D.I.C. for postgraduate course in the Theory and design of structures at Imperial College, London, England. Some experience in surveying. Presently employed at the design of buildings and other structures required for mining plants. Desires position which would give him some experience in reinforced concrete or steel design or construction. Location preferably Toronto or Montreal but will also consider others. Apply to File No. 3927-W.

GRADUATE CHEMICAL ENGINEER of Delft Technical University (Netherlands), 1942. Eight years experience in petroleum refining. Presently unemployed. Married, 2 children. Planning to settle in Canada. Interested in any position in oil industry preferably petro chemical branch. Prefer Toronto area. Speaks English, French, Dutch, German and Spanish. Apply to File No. 3929-W. Also interested in other industries.

METALLURGICAL ENGINEER, Jr.E.I.C., age 28, single. One year's experience with electric furnace steelmaking and one year with melting department of magnesium and aluminum foundry. Interested in research and development work. Available by June 15th. Apply to File No. 3930-W.

PLANT ENGINEER, Mechanical, Queen's, 1944, M.E.I.C., 1947, six years with small food processing plant, wants position assistant or plant engineer with larger company. Experience comprises operation and maintenance of L.P. boiler, elevator, air conditioning and drying equipment, freon and ammonia cooling systems. Also responsible selection layout and erection of new ammonia plant, chemical humidifier, and independent design of new type drier. Salary five thousand or more depending on location and permanence. Available about three months' notice to present employer. Preferred location central Canada or U.S.A. Apply to File No. 3935-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., graduate University of Alberta, 1949, married, veteran, 31, presently employed by public utility as underground distribution and relay engineer desires position in Alberta. Previous experience in radar, and with heating and ventilating contractor. Would welcome position with responsibility. Interested in working into management position. Apply to File No. 3938-W.

ELECTRICAL AND MECHANICAL ENGINEER, Jr.E.I.C., fluently bilingual; seeks position as maintenance or assistant plant engineer in textile or paper mill; oil or chemical industry; electric power station. 3 years previous experience as project engineer and field work supervisor in: heating, air conditioning, piping, thermo electric power stations. Apply to File No. 3945-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc., 1948, M.Sc., 1950, age 26, married. Two years experience in responsible position with public utility. Experience includes distribution system planning, line design and construction, hydro-electric power generation and transmission, street lighting, estimating and system appraisal. Desires position in Western Canada. Available October 1st. Apply to File No. 3946-W.

CIVIL ENGINEER, U. of T., 1935, M.E.I.C., P.Eng., of Ontario. Desires position of Planner with a municipality, industrial concern or consulting firm. Experienced in design and construction of sewage and water systems, roadwork, power distribution, land survey, drainage, housing layout and town planning. 5 years Naval service on armament building design and construction. Discharged with rank of Lt. Commander. Last 3 years associated with R.C.A.F. in civilian capacity, engaged in layout of buildings and design of services for defence projects across Canada. Apply to File No. 3947-W.

ELECTRICAL MECHANICAL ENGINEER, S.E.I.C., 1951 graduate, age 27, single, fluently bilingual, completed G.E. Test Course with summer experience as electrician, seeks employment for position leading to plant or maintenance engineer, in large or medium size plant located in Montreal. Salary expected $300 or better, will be available June 2nd. Apply to File No. 3948-W.

CIVIL ENGINEER, M.E.I.C., available for part time work, Montreal area, concrete, structural steel, timber designs, detailing, quantity take off, inspection service, etc. Available for short periods or other suitable arrangements. Apply to File No. 3949-W.

MECHANICAL ENGINEER, Jr.E.I.C., Queens, 1948, R.C.A.F. veteran, age thirty-one, married. Four years experience in basic heavy industry in supervisory production position. Available July or before if required. Apply to File No. 3950-W.

CIVIL ENGINEER, McGill '48, age 25, Jr.E.I.C., Affil. Mem. C.I.F., seeks employment with a pulp and paper or logging industry in field or office, or in sales and industrial relations of the allied industries. No location preference. Past 3½ years spent on reconnaissance, location and construction of mountain and forestry roads, and erection of small timber bridges. Has own car. Apply to File No. 3951-W.

MECHANICAL ENGINEER, age 29, British, Hons. B.Sc., (Glasgow); Assoc. R.T.C.; M.S. (Illinois); A.M.I. Mech.E. Experience includes student apprentice, 2 years air engineering officer, Royal Navy, in charge of maintenance workshops, 3 years college lecturing at undergraduate level in heat engines and mechanics, 5 years varied research experience including lubrication, wear and strength of materials. At present employed as research engineer in U.S.A., desires suitable position in B.C. with expanding company where pleasant personality and intelligent application of engineering principles required. Apply to File No. 3952-W.

CIVIL ENGINEER, age 26, British, B.A. (Hons.), Cambridge. Desires position in British Columbia with Civil Engineering firm or construction firm to work preferably in field but not necessarily. Experience as student apprentice, 2½ years in Royal Engineers as 2nd/Lt. training recruits in bridging, roads, etc., 1½ years as Junior Design Engineer in County Dept. of Public works in U.S.A. At present employed by firm of civil engineers and land surveyors in U.S.A. Apply to File No. 3953-W.

JR.E.I.C. GRADUATE would undertake on part time basis calculations, quantities and drawings of structural design, reinforced concrete, underpinning, soil mechanics and stabilization, sewerage and sewage disposal, water supply. Apply to File No. 3954-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., married, presently employed. Over 25 years in pulp and paper industry. Supervising experience on design, installation and maintenance. Familiar with manufacturing methods. Desires responsible position with consultants, mills or manufacturers. Apply to File No. 3956-W.

News of the Branches

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

Belleville

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

Annual Meeting

The Belleville Branch of the Institute held its first regular annual meeting at the Hotel Quinte on April 28th with 27 members present.

Mr. Gurnett, the chairman, opened the meeting by noting that the form of the meeting would follow the agenda as set out in the proposed by-laws.

Mr. Gurnett briefly outlined the activities of the Branch under his chairmanship. The secretary-treasurer presented a report on the membership of the Branch and also a financial statement.

Mr. Gurnett then introduced the matter of the proposed by-laws. A short discussion on various interpretations of the by-laws followed. It was moved by Mr. H. J. Legate and seconded by Mr. W. C. Benger that the by-laws as drafted and submitted be approved. A letter ballot will be prepared and forwarded to all corporate and junior members to obtain final approval of the Branch.

Mr. Gurnett read correspondence which he had received from the Belleville Branch of the Ontario Industrial Educational Council. The council had requested that a representative from our Branch attend its meetings. Unfortunately, to date its meetings occurred at the same time as our Branch meetings and so no representative has been present. After some discussion it was unanimously agreed that the Branch should cooperate with this Council. It was moved by Mr. E. Littlejohn and seconded by Mr. R. I. Davis that Messrs. C. R. Phillips and A. Argue represent the Branch on the Belleville Branch of the Ontario Industrial Educational Council.

An official statement of the Council was read by the Chairman which clarified the President's and Council's views on the remuneration of professional engineers. Dr. Macnab's remarks had been misinterpreted previously by the press and this statement was read to correct any misunderstandings on the part of the members of the Branch.

Mr. S. Sillitoe, Councillor, announced that he was pleased to be able to represent the Branch at the annual meeting of the Institute to be held in Vancouver.

As there was no new business to bring before the meeting by the members, Mr. Gurnett as chairman of the Nominating Committee read the proposed slate of officers for the new year. There were no further nominations from the floor and it was moved by Mr. F. C. Adsett and seconded by Mr. W. L. Langlois that this slate of officers be accepted and the nominations closed.

The new executive is composed as follows: Chairman, G. A. Bradford; Vice-Chairman, C. R. Whittemore; Councillor, S. Sillitoe; Committee, A. O. Drysdale, J. H. Legate, A. O. Janitsch, E. L. Littlejohn, J. C. R. Punchard and A. E. Argue.

Mr. Bradford then assumed the chairmanship of the meeting. A brief announcement was made by Mr. A. O. Drysdale regarding the May meeting, and a short discussion followed regarding the nature of a meeting in June.

At the conclusion of the business meeting there followed a social hour with entertainment supplied by Mr. L. G. Fozard of Belleville and Mr. L. A. Blaker accompanied by Mrs. E. Warham. Refreshments were served.

Meeting of May 19

G. A. Bradford, Chairman of the Branch, presided at the meeting held in the Masonic Temple on May 19. Twenty-nine members were present.

Mr. Bradford announced that there would be no June meeting and that the next regular meeting would be held on the second Monday in October.

Mr. S. Sillitoe then gave a brief description of the recent Annual Meeting of the Institute in Vancouver.

Mr. E. L. Littlejohn introduced the speaker, Mr. T. C. Powell, M.E.I.C., of the Johns-Manville Co. whose address was on the subject of **Celite.** A most interesting film on the manufacture and uses of Celite was also shown.

Celite is the trade name of the Johns-Manville Co. for diatomaceous earth. At the present time this company owns a deposit of Celite at Lompoc, California which covers an area of more than 5 square miles and is estimated to contain more than one hundred million tons of crude Celite. The formation of this material began more than 5 million years ago when this area was covered by the sea. With the gradual retreat of the water, minute marine life remained in countless number which over the years became fossilized and formed this deposit. The minute particles of Celite are known as diatoms. The great diversity of shapes and sizes of the diatoms accounts for the many unique properties of Celite.

At this deposit the Celite is simply mined with huge electric shovels. It is then milled and crushed and separated into various grades and sizes. The material is then transported in carload lots to various centres throughout the U.S.A and Canada.

Celite is used as a filter aid and mineral filler in various industries due to its unique physical and chemical properties. It is used in the filtering of such properties as alcoholic extracts, beer, cider, wine, sugar, shellac, water, dyestuffs, petroleums, and many others. It should be noted that in 1900, 100 per cent of the Celite production was used in the sugar industry. Now, due to its increased uses and applications, only 25 per cent of the total production is used in that industry.

Celite mineral fillers have become highly important to many industries. Its properties, such as great bulk per unit of weight, high liquid absorption capacity, large specific surface, high porosity, low apparent density, and relative inertness, make it most useful as a filler As a filler it is used in the manufacture of adhesives, crayons, decals, dyes, fertilizers, insecticides, plastic, polishes, matches, and soap, as well as many other familiar products.

The use of Celite has also benefited the quality of concrete by improving its workability, uniformity, and by increasing its water-tightness and resistance to attack by salt or alkaline waters.

At the conclusion of the address and showing of the film, the appreciation of the Branch was expressed by Mr. A. E. Argue.

Edmonton

John L. Pulford,
Secretary-Treasurer

Annual Meeting April 21

The annual meeting of the Edmonton Branch of the Engineering Institute of Canada was held at the Macdonald Hotel, Edmonton, on Monday, April 21st, 1952.

The Branch was honoured to have as a guest speaker on this occasion Dr. Ira P. Macnab, president of the Institute, who was passing through Edmonton on his Western visit.

Committee Reports for the past year were presented and adopted. A copy of these committee reports available before the meeting is attached. In addition a report of the Membership Committee was presented by H. W. Tye, Chairman, and the report of the Audit Committee was presented by Roy Nurse.

Election of officers for the ensuing year then took place and the following members were elected: Chairman, B. F. Willson; vice-chairman, N. J. Allison; executive (2nd term), F. V. Seibert, L.

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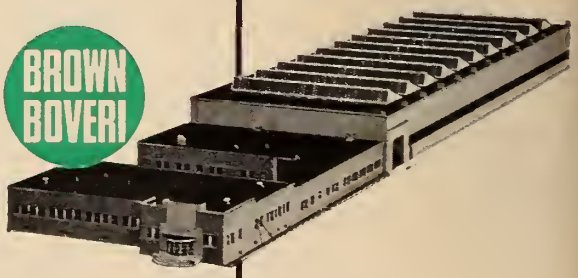


Representatives:
GORDON RUSSELL Ltd., Vancouver
POWER & MINE SUPPLY Co. Ltd., Winnipeg

E. Gads, H. L. Roblin; executive (1st term), C. A. Davidson, Roy Nurse, C. Z. Monaghan; secretary-treasurer, John L. Pulford; auditors, P. A. Clarke, H. W. Klassen.

E. L. Smith, Chairman for the previous year then turned the meeting over to B. F. Willson who was congratulated by Dr. Macnab on his election to office. The incoming Chairman then moved a hearty vote of appreciation to the outgoing executive for the excellent work that they had done in the past year.

Mr. Willson then called upon E. L. Smith to introduce the speaker of the evening President Macnab who delivered a very enlightening address on **The Work Of The Engineer** using as a basis his trip across Canada from the East Coast of Newfoundland to the West Coast of British Columbia.

The speaker was thanked by T. E. Bate, retiring Secretary-Treasurer and a motion was made to end a very successful meeting.

Refreshments were then served and the members of the Edmonton Branch were given an opportunity to meet Dr. Macnab personally.

The Edmonton Branch executives, incoming and retiring, photographed with Dr. I. P. Macnab, president of the Institute. Front row, left to right: N. J. Allison, B. F. Willson, Dr. Macnab, E. L. Smith and Roy Nurse. Back row, left to right: T. E. Bate, C. Z. Monaghan, J. L. Pulford, C. A. Davidson, L. E. Gads and F. V. Seibert.

Halifax

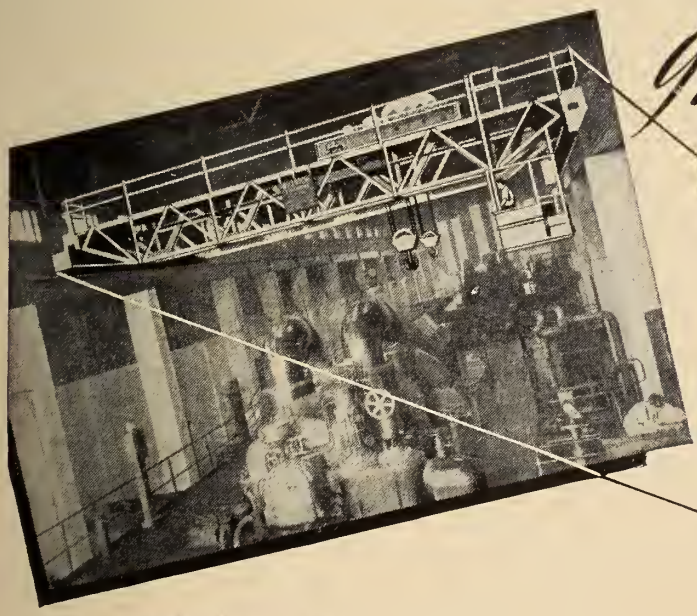
W. E. Jefferson, M.E.I.C., *Secretary-Treasurer*

J. P. Dumaresq, M.E.I.C., *Branch News Editor*

Supper Meeting, May 1st

A group of eighty, attending the meeting of May 1st, at the Nova Scotian Hotel, included members of the Steam Turbine Committee of the Canadian Electrical Association. The speaker was F. E. Baumann, M.A., A.M.I., MECH.E., of Metropolitan-Vickers Electrical Company, Manchester, England, and his subject was **Gas Turbine Power For Generation.**

Mr. Baumann said that gas turbines



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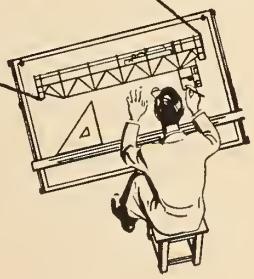

REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL, P. Q. (Walter M. Smith — President). MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. BRITISH COLUMBIA: Vancouver Engineering Works Ltd., 519 to 659 West Sixth Avenue, VANCOUVER, B. C.

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have an excellent future in Canada. He described the various practical applications of the gas turbine in modern industry. In tracing the history of the gas turbine, Mr. Baumann said that a great deal of the progress now being made in that field could be attributed to the rapid development of the jet engine, closely allied with gas turbines.

Most notable in his company's recent progress along this line has been the design of the "Sapphire" jet engine, soon to be installed in the battle-tested Sabrejet to give it added power.

Mr. Baumann added that gas turbine locomotives will give keen competition for diesel locomotives, and will be practical in Western Canada where natural gas is available.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

B. A. Warren, Jr.E.I.C.,
Branch News Editor

April Meeting

The final meeting of the spring program of the Hamilton Branch was a joint meeting with the Toronto Section of the A.I.E.E., in the Auditorium of the Steel Company of Canada.

Branch Chairman W. L. Hutchison opened the meeting and turned it over to H. R. Osborne of Ferranti Electric, Chairman of the Toronto Section A.I.E.E., who called on E. M. Coles of the Canadian Westinghouse to speak briefly. Mr. Coles asked Mr. A. A. Moline to introduce the speaker, Mr. F. E. Baumann.

Mr. Baumann, of the Metropolitan-Vickers Electrical Company, of Manchester, England, spoke on **Gas Turbines for Power Generation.** His talk, illustrated with slides, showing installations and important parts of gas power plants, was very well received by the large group in attendance.

Mr. Baumann discussed the thermal and mechanical features of gas turbines and described how one gas turbine replaced four diesel engines to power a tanker across the Atlantic Ocean.

Mr. C. E. McWilliams, chairman-elect of the Toronto Section of the A.I.E.E. and of Canadian General Electric, thanked the speaker for his enlightening presentation of such an interesting topic.

The meeting was adjourned and the group enjoyed hot beef sandwiches through the courtesy of the Canadian Westinghouse, co-host for the evening.

Kootenay

T. W. Lazenby, M.E.I.C.,
Acting Secretary-Treasurer

Annual Meeting, February

At the annual meeting of the Kootenay Branch in February, the speaker was the Right Rev. F. P. Clark, M.A., D.D., Lord Bishop of Kootenay, who, on the subject of **Science and Religion,** interested his audience very greatly. The address was later distributed to members of the Branch.

Bishop Clark said "Our world is more shaken than it has ever been in our lifetime"; and he spoke of the great crisis brought about by what he terms as "a shift in the balance of moral prestige".

"We of the New World", he said, explaining his theory, "have assumed . . . . that we are destined to right the wrongs perpetrated by others in other parts of the world". Suddenly we are bewildered at being looked upon by a large part of the inhabitants of the earth as an oppressor rather than a benefactor.

Historical, scientific, and philosophic changes of a revolutionary nature have occurred, and the most profound shock is the realization that peace has not come. We are disturbed by the primary questions, "What are we to believe", or "What is secure?"

"There are some of us who believe that all these questions can be answered, and all problems solved, in the practice of the implications of a strong religious faith. It would be easy to blame the modern world for ignoring Christianity . . . . if Church religion showed any strong signs of spiritual life.

"The point needs no further stress", said Bishop Clark, talking of the decline of religion, "for quite apart from all the philosophical, sociological, psychological and scientific arguments that have been put forward from time to time, the fact that a creative and relatively sane society must in some way or other be dominated by religion is fully proved by the destructive and insane state of the first radically secular civilization in history — our own".

The need is for a "union with life, with reality itself".

A review of the oft-discussed theories as to the presence or absence of conflict between faith and reason, or between religion and science was made. The conclusions of great thinkers have been that "both religion and science are valid".

The methods of experimental science and theoretical science were reviewed by Bishop Clark and the conclusion reached that "we need all the science we can get, and we still need all the philosophy and religion we can get. Science need not be a barrier to religion, but rather an open door".

London

R. G. Newell, Jr.E.I.C.,
Secretary-Treasurer

I. D. Patterson, M.E.I.C.,
Branch News Editor

April Meeting

The regular monthly meeting of the London Branch was held on Tuesday, April 13 at Wolseley Barracks Reserve Force Officers' Mess. About forty members were present.

The speaker was Mr. Barry Graham of the Aluminum Company of Canada. His address was illustrated with coloured slides showing the Aluminum Company's expansion program in eastern and western Canada.

Talking of the East, Mr. Graham outlined the 200,000 hp. powerhouses being built on the Peribonka River in the Saguenay area and the new aluminum smelter facilities to be operated with this power at Isle Maligne, Quebec.

Coloured diagrams of Aluminum Company's British Columbia Project and pictures of work completed to date explained the Company's new hydro-electric and smelter expansion at and near Kitimat, British Columbia. It is now planned that initial aluminum production from this expansion will be about 100,000 tons of aluminum per year but when the market warrants it, completion of the project will double Canada's present aluminum production.

Of particular interest were the details of the construction of the world's largest underground powerhouse in which will eventually be located the world's largest Pelton wheels and also the details of the fifty mile transmission line over mountainous terrain.

Mr. Graham explained that this project is scheduled to produce additional aluminum for Canada in 1954.

Niagara Peninsula

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

J. S. Ellis, Jr.E.I.C.,
Branch News Editor

April Meeting

The April meeting of the Institute featured a paper by Mr. Charles Miller, M.E.I.C., on the Manicouagan River diversion for McCormick Dam construction. Mr. Miller is manager of construction and chief hydraulic engineer for the Ontario Paper Company and his paper dealt with the hydraulic engineering aspects of diverting a large river for the construction of McCormick Dam to provide more hydro-electric power for the paper mill at Baie-Comeau. The speaker illustrated his address by slides and a coloured film.

Mr. H. Treble, M.E.I.C., expressed the appreciation of the members to Mr. Miller for his interesting and informative paper. At the conclusion of the meeting light refreshments were served through the courtesy of the Ontario Paper Company.

Annual Meeting and Dance

At the Park Restaurant, Queen Victoria Park, Niagara Falls, the Branch annual meeting in May was the occasion of a dinner for members and their wives and friends, followed by dancing to the music of a fine orchestra.

At this meeting the newly elected executive was introduced: G. A. Bennett, chairman; P. A. Pasquet, vice-chairman; G. Richardson, secretary-treasurer; A. Bennett, J. Smith, H. Treble V. Harrison, W. Inman and W. Neale. The dinner dance concluded, in a delightful manner, a year of many worthwhile and well attended events which the Branch has provided for engineers in the Niagara Peninsula. For the success of the year's activities, much credit is due to G. A. Bennett, branch chairman, and G. W. Ince, secretary-treasurer.

St. Maurice Valley

D. G. Demianiw, Jr.E.I.C.,
Secretary-Treasurer

Senior Branch

On March 26, 1952, the members of the branch heard Mr. E. A. Walton, assistant economic advisor of the Bank of Montreal, discuss Canada's present economy and predict what Canadians might expect in the future.

The meeting was held at the Hotel Chateau de Blois, Trois Rivieres with an attendance of 35 members. The speaker was introduced by Mr. D. E. Covey and thanked by Mr. J. F. Wickenden.

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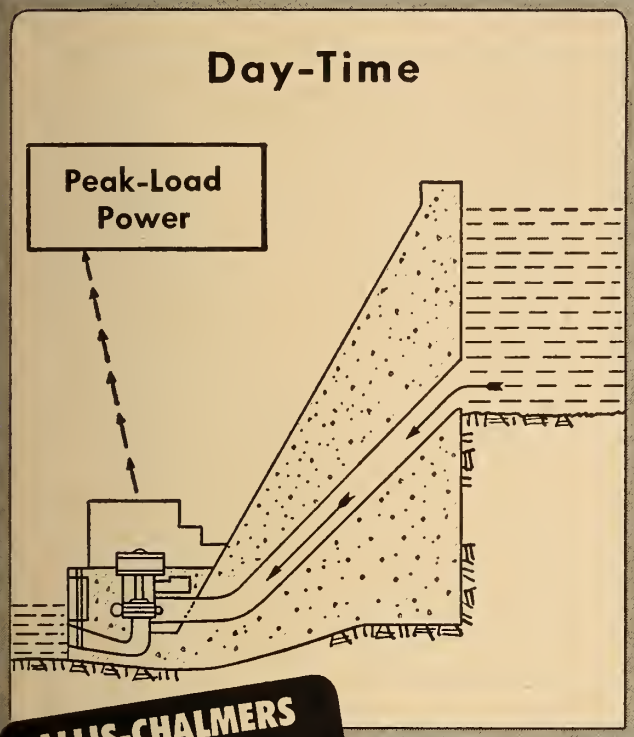

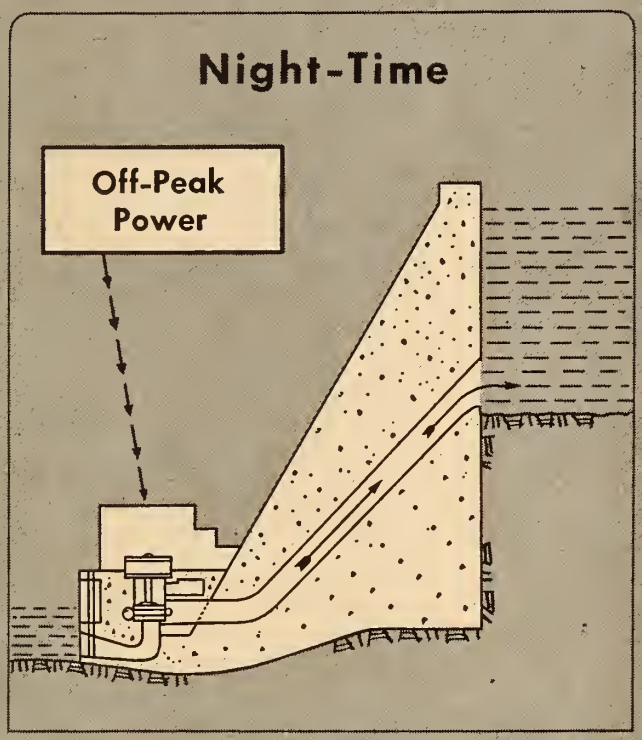

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Mr. Walton, with the aid of a work sheet which was distributed to the listeners, traced the growth of Canada's economy during the past two decades. He then proceeded to predict the changes to be expected in Canada's economy in 1952-53. The Canadian economy, according to Mr. Walton, will continue to be divided into two parts; one part of our resources will be devoted to our defence effort and the other to the normal development of our nation.

The fact that we have recently achieved a certain stability in prices would indicate that we are entering a new economy. It is possible that the profit margins will be readjusted; business leaders must approach the problem of price increases more cautiously. The Minister of Finance must also expect a reduction in the budget surplus.

The Canadian and United States economies both depend on heavy defence expenditures. The ultimate result of these programs is not so much as to increase the arms production but to establish a vast reserve which would permit, in case of an emergency, a guarantee of certain security.

It is generally believed that these defense expenditures will reach a maximum and then return to a level lower than we have been accustomed to in recent years. In the U.S.A. this peak will be reached sometime during the end of 1953 while, in Canada, it is expected at the end of next year.

Already in many places, the end of these big defence projects can be predicted. More important are the industrial development projects which will only reach the production stage during 1954-55. Amongst these various projects can be mentioned such names as Labrador, Hogarth, Kitimat, and Lynn Lake. The St. Lawrence seaway will not be completed before 1955; who is to say that at this date, atomic energy will not have replaced hydroelectric power?

The extensive question period which followed Mr. Walton's talk indicated the extreme interest which engineers have in the operation of Canada's economy.

Annual Junior Speech Night

The annual junior speech night sponsored by the branch for junior and student members was held at the Hotel Chateau de Blois, Trois Rivieres, on March 18, 1952. In attendance were 45 members and their guests.

Participants were Messrs. W. M. Balke and W. G. Brooks of Shawinigan Falls and A. T. Farmer and J. U. Moreau of Trois Rivieres. Winners of the prizes were W. G. Brooks (1st prize, $15) and J. U. Moreau (2nd prize, $5).

Judges were Messrs. E. E. Copping, A. M. Hubley, and E. R. McMullen of Trois Rivieres.

A summary of each talk is given below:

"The Control of the St. Maurice River" by W. G. Brooks, (1st Prize)—The St. Maurice River drops a total of 1,300 feet in its length of 235 miles between its source at the Gouin Reservoir and its mouth at Trois Rivieres. Between these points there are generating stations installed at six different locations producing a total of 1,572,500 hp.

The flow of the river is controlled through the operation of three main reservoirs to give a firm regulated flow, as measured at the Grand'Mere power development, of 22,000 cubic feet per second. This flow is utilized in all generating stations and the system load is so divided between them that all the water is used at all the stations without spillage except during periods of abnormally high riverflows which occur during the spring.

There are many other factors requiring much skill and careful thought to assure that the most hydroelectric power will be produced for use in Quebec's industries.

"The Use of Plywood for Structural Members" by J. U. Moreau, (2nd prize) —Mr. Moreau described the assembly of wooden beams from plywood and standard lumber. Such a beam, he pointed out, has a web of plywood and flanges of standard lumber and is held together by waterproof glue and equally spaced lumber stiffeners. He also explained the advantages and disadvantages of such built-up beams and compared them with steel beams and wooden trusses as to cost. The speech concluded with a discussion of the factors entering into the design of a plywood beam.

"Methods-Time Measurement" by W. M. Balke—Mr. Balke spoke on "Methods-Time Measurement — (MTM), a New Tool in the Industrial Engineer's Kit." His introduction stressed the need for an accurate tool for work measurement since labor is now one of the highest single items in most manufacturing costs. He contended that MTM was one of the most accurate tools in this field; the method enabled one to do accurate "spadework" whereas the conventional time study "bulldozer" was too rough and clumsy. By comparing an "MTM man" and a "Time study man" in action Mr. Balke contrasted the two approaches and illustrated the superiority of the MTM results. However in conclusion, he emphasized that MTM is founded on the labors of the "fathers of time study" and MTM has actually welded together "Methods" and "Time Study" as shown by the hyphen in the name "Methods-Time Measurement".

"The Canadian Electrical Association" by A. T. Farmer — This speech traced the growth of the Canadian Electrical Association from its inception about 1890 up to the present time. Mr. Farmer outlined some of the activities of this organization and stressed the benefits it has provided and continues to provide to the Electric Power Industry in Canada.

Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

Dr. J. A. Retty Addresses the Branch

On Tuesday, April 29th, Dr. J. A. Retty addressed sixty members and friends of the Saguenay Branch at the Auditorium of Aluminium Laboratories, on the subject of **The Iron Ore Development in New Quebec and Labrador.**

Dr. Retty was born and bred in the Province of Quebec, at Fort Coulogne, a historic spot on the Ottawa river. He studied first at Ottawa University and then at Princeton, where he graduated with a Doctorate in Geology. After several years with the Quebec Department of Mines, he responded to the challenge of that vast, virtually unknown area of Precambarian rocks, the Labrador Peninsula.

Several years of preliminary exploration were inconclusive. Then he induced Jules R. Timmins to sponsor a serious search for deposits of iron ore in the great iron range that Dr. A. P. Low had located fifty years before. The

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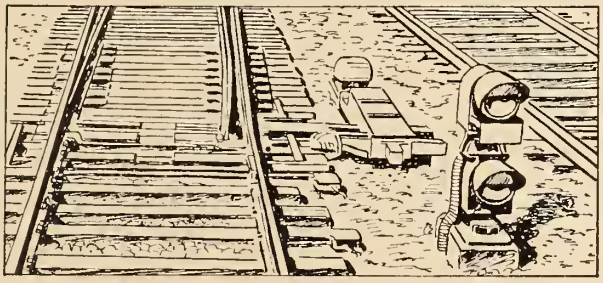

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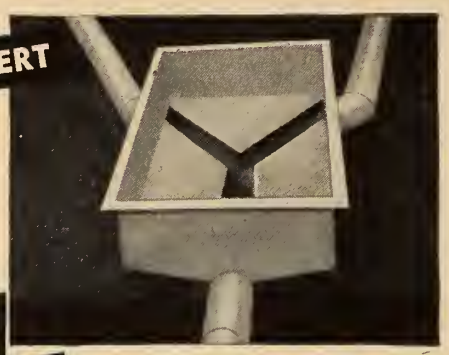

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present iron ore development in Labrador and New Quebec is a tribute to Dr Retty's foresight and determination.

Dr. Retty explained the present organization of the Exploration Companies now in operation in Labrador and Quebec. Hollinger North Shore and Labrador Mining Co. are the Exploration Companies both of which are subsidiaries of Hollinger Consolidated Gold Mines Ltd. The company which will actually mine the ore is called Iron Ore Ltd. and is a wholly-owned subsidiary of six American Steel Companies.

Dr. Retty stated that while the capital required for this project was available in Canada, only United States interests had both the capital and the required market for the ore. There are two main reasons for the development of Northern Quebec and Labrador deposits in place of the large deposits in South American countries. The first reason is one of logistics; the over-land St. Lawrence Great Lakes route for Canadian ore is easier to protect in wartime than the ocean route from South America. The other is that Canada has a reputation for stable government so that private interests feel safe in investing money in this country.

This development is completely airborne, the Company having thirteen aircraft and transporting 33,000,000 pounds of freight per year in this way. A railway is presently under construction from Seven Islands to Knob Lake, some 360 miles inland. The company has developed or will develop power sites on the St. Marguerite River, at Knob Lake, Wanabee Rapids, Eton Canyon and Grand Falls to a total capacity of 1,740,000 hp.

Dr. Retty showed an extremely interesting movie which complemented his address.

The speaker was introduced by Mr. D. F. Nasmith, Chairman of the Meeting and was unanimously thanked by all members. An informal discussion followed the meeting.

Winnipeg

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

Electrical Section

J. G. Dickinson, M.E.I.C.,
News Editor

Meeting and Field Trip

Mr. T. L. Woodhall, chief engineer of the Manitoba Power Commission, described some of the aspects of the M.P.C., its history and its growth to a meeting of the Section on May 8. The meeting was followed by a trip to Parkdale Substation which is some 14 miles north of Winnipeg and is the main M.P.C. switching station. Those who went were also rewarded with a lunch, courtesy Manitoba Power Commission.

Mr. Woodhall began by drawing the organizational chart of the system and described how closely the departments tie in one to the other, both in practice as well as on paper. There are approximately 490 staff members and up to 1,000 additional workers on construction. Construction generally is most active during summer but during the last winter, thanks to favourable weather, much work continued. To aid the construction department a special system of symbols was adopted whereby the pole line draw-

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ing could be very easily prepared at the engineering office and very simply and speedily interpreted on the job.

Due to the tremendously ambitious programmes undertaken — some 27,000 farm customers connected in seven years, the whole operation was one of mass production and economy. With an average of one customer every ¾ mile, it is next to phenomenal that so much could be done so soon for so little. Such things as special Hi-Con steel conductor class 7 and 8 poles, black hardware unfused distribution transformers with spark gap lightning protection and a host of other engineering economies were at the time considered most daring by many operating utilities. The record of the M.P.C. proves so far that outages are at a minimum and operating costs as low as any. Even a very serious sleet storm over a large section of the line in May 1950, did not cause excessive damage. At full load, receiver terminal voltages are rarely below 120 volts and not over 125 volts at no-load.

The Manitoba Power Commission was organized by legislation in 1919 to distribute electrical energy to the rural municipalities. Construction began with a line to Portage la Prairie on two-leg steel towers. This did not prove too successful however because a severe wind storm in 1921 and 1922 all but destroyed the lines after which a third leg was added to all towers.

A 115-kv. system forms the backbone of the system with sub-feeders of 66 kv. and 33 kv. This voltage is stepped down to 6,900, and some to 4,000 to be carried on single pole lines in the area, to customer premises. Some of the distribution is of the single wire with ground return. A great deal of work has been done testing soil conditions to determine ground resistance over the province. Convenient tables have been calculated giving the per cent voltage drop per kw. mile uniformly distributed for the various line wires used, which is mostly special high conductor steel but can be ACSR, CCSR or alloy aluminum.

Distribution to the farmers really only began after cessation of hostilities in 1945. Currently over 5,000 farms are connected per year. The total connected customers now stands at over 75,000, of which over 27,000 are farms.

Many recalled the paper by Mr. J. Tomlinson in February, 1945, who was then assistant general superintendent, Manitoba Power Commission, outlining the ambitious plan. We also recalled the good deal of skepticism with which it was regarded. (References—Engineering Journal, April 1945.)

The engineers of the M.P.C. are justly proud of their tremendous achievement and of the resulting benefits which all of Manitoba and particularly rural Manitoba have gained by it.

Meeting of April 28, New United College Building

The Electrical Section of the Winnipeg Branch, was favoured by a very timely paper entitled **Gas Turbines for Power Generation,** presented by Mr. F. E. Baumann, gas turbine specialist, Metropolitan Vickers Company, Limited. Mr. Baumann was sponsored by Canadian Westinghouse Company Limited, Winnipeg.

Mr. Baumann described gas turbine theory by means of curves and diagrams. Photographs of machines in building and in service added interest.

In the paper an attempt was made to indicate the capabilities of open cycle gas turbines for power generation on the basis of existing knowledge and technique and to illustrate the form they are taking. Any assessment of the future commercial prospects of gas turbines is dependent not only on a study of alternative prime movers but on estimates as to the future trend of fuel prices and on assumptions regarding maintenance and upkeep costs for gas turbines and it would be folly to draw more than very general conclusions.

Design and tooling charges for gas turbines are high, so final costs of a gas turbine are largely dependent upon the scale of production. Gas turbines should cost less than diesel engines or boilers plus steam turbine, and there should be savings in civil engineering and building costs.

At the present time gas turbines are not developed to burn coal and until this is the case, steam turbines must be preferred to gas turbines for base load plant in countries where coal is freely available and cheaper than other fuels. The gas turbine however, deserves serious consideration for peak load and standby duties, for which it promises a saving in capital costs, low maintenance charges, no standby losses and ease of starting. A simple gas turbine demands no cooling water and a compound gas turbine less cooling water than a condensing steam turbine.

The most promising field for gas turbines is in powers ranging from 1,000-kw. to 20,000-kw., and an attractive case can be made for installing gas turbines as standby for hydro-electric generating plants or as base-load sets where natural gas or oil fuels are relatively inexpensive.

The gas turbine rejects large amounts of heat to exhaust at a temperature between 200°C. and 400°C. but it is difficult to employ this without losing considerable power due to the resulting back pressure on the turbine. The choice of prime mover to satisfy combined power and heating requirements is generally a matter for individual consideration in each case.

Combined gas-steam cycles offer the possibility of high efficiency but they involve some degree of complexity in layout and operation and should be compared with proposals for refinements to straight gas or steam cycles which necessitate no greater complexity or initial cost of plant.

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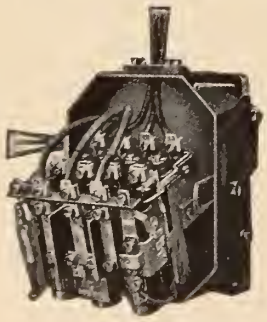

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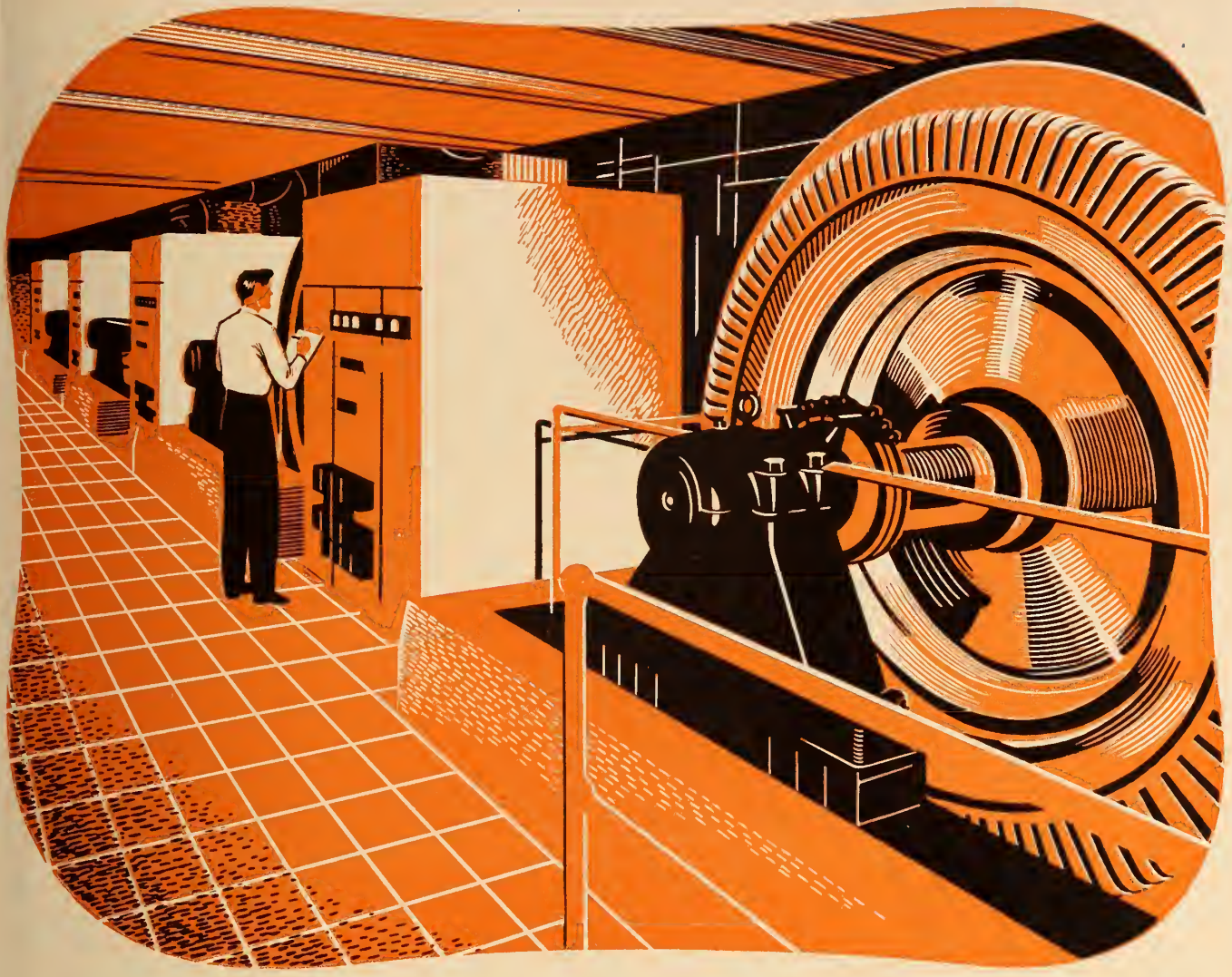

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

British Standards Institution
"SAFETY" COLOUR CODE

We thought the following communication would be of interest to a number of our members. We are therefore publishing it in full.

"We usually ask for your help in telling your readers something of what the British Standards Institution has done. This time, however, we are giving a note about something we have **not** done—believing that the subject itself and the reasons for inaction may be of general interest.

"During recent years Industry has given increasing attention to colour coding of danger points in factories to indicate high voltage lines, toxic gases, and obstructions such as low doorways and steps and other varying degrees of hazard, and a Committee of the British Standards Institution, representative of a wide variety of experience, has been considering the possibility of preparing a 'safety' colour code in order to secure unification of the present different practices.

"The Royal Society for the Prevention of Accidents made an extensive enquiry on behalf of the committee, as a result of which and of other investigations, it has now been decided to abandon the attempt to prepare a code. As the reasons for this decision will be of interest to all sections of industry, they are set out below.

"Examination of the problem showed that a distinction must be made between a **safety** colour code and an **identification** colour code—the purpose of the former being, broadly, to classify types of hazard and to give warning of them by colour, whilst the object of the identification code, as in the British Standards 1710 for pipe lines and 349 for gas cylinders, is primarily to identify by colour the contents, and any application to safety is incidental.

"It was the former type of code that the committee had to consider, and it was found that many colours had traditional connotations, which whilst not always consistent, were so well known that they could not be reconciled.

"The second difficulty was that the only truly satisfactory method of ensuring safety is to eliminate the hazard, and the committee felt that a code might encourage identification of hazards by colour instead of their removal.

"Thirdly, the increase in the scientific use of colours for decoration to secure better light and to improve working conditions detracted from the effectiveness of a safety colour code, and these schemes of colour treatment were considered to be more effective in the reduction of accidents.

"A fourth and important point arose from positive evidence submitted showing that the significance of colour codes put into effect had been quickly forgotten. Whilst this is relatively unimportant in the case of an identification colour code where time is not vital, it was felt to militate seriously against the use of a safety code where recognition and significance of colour must be immediate and instinctive".

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BOOK NOTES

Prepared by the Library of The Engineering Institute of Canada

Engineering design, 3rd ed. J. E. Taylor and J. S. Wrigley. Toronto, Pitman, c1951. 137 pp., illus., $9.75 (approx.)

This book deals with mechanical engineering and is divided into two parts. The first is short and consists of a few pages on stresses, fatigue, creep, gears, bearings, etc. The bulk of the volume, however, consists of nineteen designs of mechanical apparatuses. In each case, the problem is stated, illustrated and solved. Line shaft, dry single-plate clutch, wall crane, venturi meter, are a few examples. It is intended that the matter of the book will meet the requirements of students in engineering. In addition, it is hoped that engineers will find it useful, and, to this end, frequent references have been made to more specialized works and to recent research and practice. A short bibliography and an index are included.

Foundations of high speed aerodynamics: facsimiles of nineteen fundamental studies as they were originally reported by the investigators, the leaders in the field, with a bibliography compiled by G. F. Carrier. New York, Dover, 1951. 286 pp., illus., paper. $1.75.

Dover Publishing Company may possibly be starting a new vogue in book format in the technical field.

For general and light reading this "paper back" has become a fairly familiar sight. To those of us accustomed to handling French books, any subject may turn up in a paper binding.

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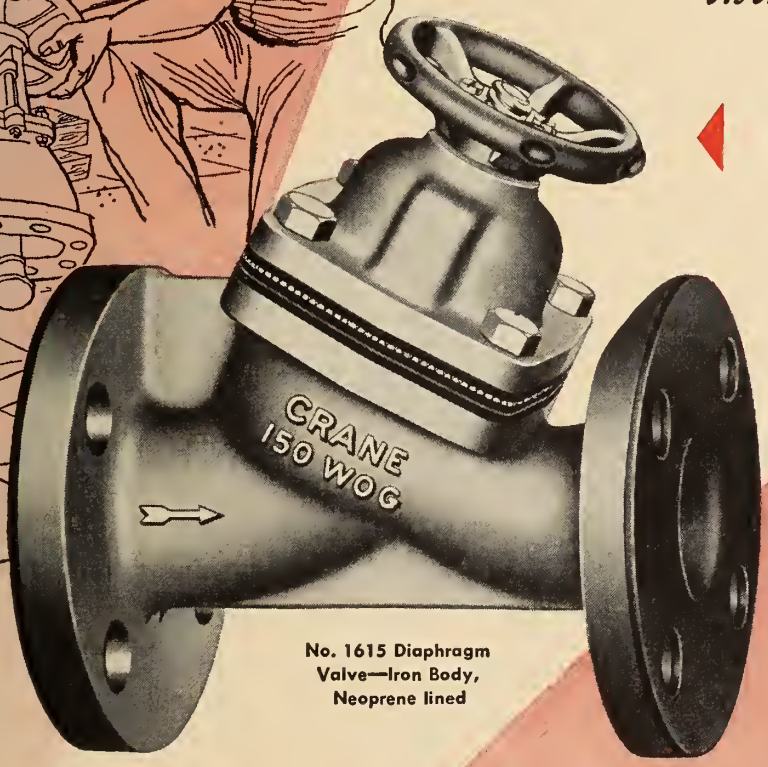

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Dover may just have found what seems to be the logical answer to a very vexing question. In addition to the paper cover, the text is printed by varytyper, and reproduced by photo-offset.

This particular volume is the second of the Dover Foundation series, and is in two parts. The first is a collection of reproductions of original papers concerned with fundamental studies in the flow of compressible fluids, which makes the book broader in scope than pure aerodynamics. The second part is a theory of compressible flow bibliography; periodical titles used, and their abbreviations, are appended.

And note the price again—in paper binding it costs only one dollar and seventy-five cents.

Incentive management: a new approach to human relationships in industry and business. J. F. Lincoln. Leaside, Ontario, Lincoln electric company, 1951. 280 pp., $1.50.

In order to arouse the greatest possible amount of interest and co-operation from the worker, it is necessary somehow to arouse all his latent ability and potentialities, both mental and physical.

This incentive management, as Mr. Lincoln has termed it, had been a highly successful venture in the Lincoln Electric Company, which has progressed from bankruptcy to the leader in its field, during his term as president.

At the same time, their products are being sold throughout the world, their prices continually being reduced, and neither the workers nor the company have ever lost a single hour of production through a misunderstanding.

Incentive management warrants your attention.

Introduction to the geography of the Canadian Arctic. J. L. Robinson. Ottawa, King's printer, 1951. 118 pp., illus., maps.

Although various aspects of the geography of the Canadian Arctic have been covered in writing before, this handbook is an attempt to bring together all the facts concerning the arctic physical environment, man's adaptation to this environment, and the utilization of its resources.

The way of life of the Eskimo, and the tracks by which the white man has gradually discovered these white wastes are all included in this quite fascinating, one hundred and eighteen page booklet.

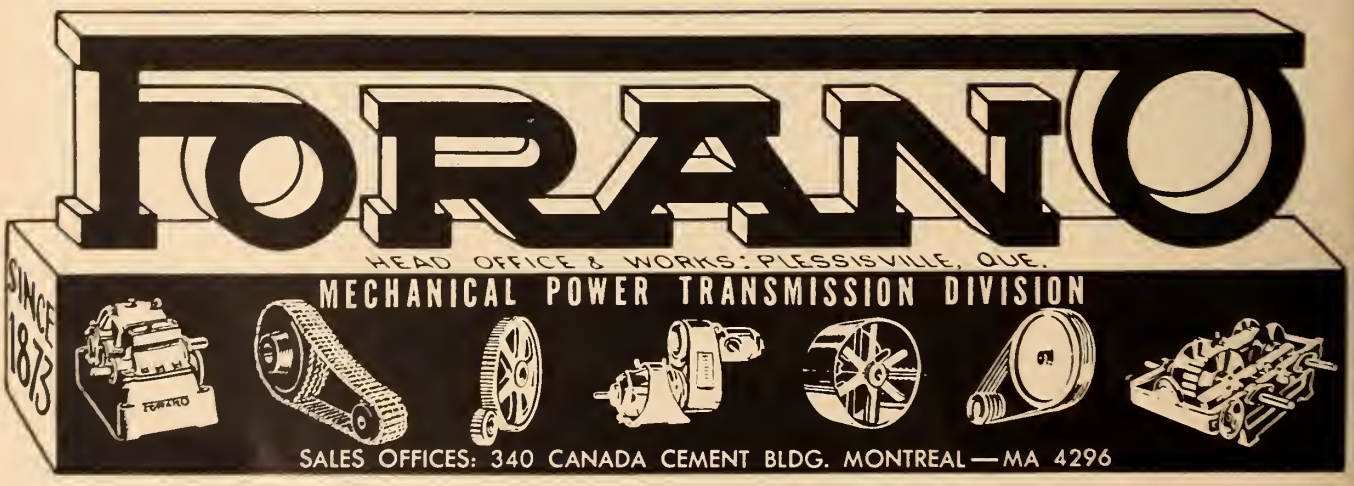
Six folded maps, and a subject arranged bibliography, add to the value of this number two in the Information Series of Canadian Geography published by the Canadian Government Department of Mines.

Modern gas turbines: with special reference to stationary, aircraft, locomotive and marine types and to the supercharging of internal combustion engines, 2nd ed. A. W. Judge. London, Chapman, Toronto, British book service, 1950. 388 pp., illus., $6.50.

The present volume is intended to give an outline of the theory and development of gas turbines to recent times and to form an introduction to the more advanced considerations of the subject as discussed in the various reference works and papers given in the bibliography. Some of the most recent developments in the fields of locomotive, aircraft, ship and stationary plant, have been studied. The controversial subject of the automobile gas turbine has also been considered and some conclusions drawn and discussed. The previously mentioned bibliography lists almost two hundred references to articles, books, reports and patents. This book contains numerous photographs and diagrams and is adequately indexed.

Partners in the free world. Boston, World Peace Foundation, c1951. 103 pp., paper, $1.00.

The Canadian-American conference on Foreign Relations met at Niagara Falls, Ontario, from May thirty-first to June fifth, nineteen fifty-one.



The object of this conference was to explore the reasons for growing differences between the American and Canadian governments with regard to the most prudent policies to be followed in the Far East. It was hoped that the ensuing discussions would lead to a clarification of present differences, the nature of the tactics to be used, and the idea of the ends involved.

The booklet makes thought provoking reading.

Pipe resistance for hydraulic, lubricating and fuel oils, and other non-aqueous liquids. T. E. Beacham. London, Spon, 1951. 61 pp., 18/-.

The object of this little book is to provide a simple and accurate means of estimating pipe resistance to the flow of oils, spirits and other non-aqueous liquids. If the designer of a piping system has no accurate information on the subject of resistance, a pipe may be made too small, in which case the fault may be eventually remedied by the expensive process of trial and error, or more often too large, adding to the cost of the installation. A series of pipe resistance diagrams is included, covering a wide range of conditions and giving an accuracy greater than that of normally available data.

Piping design and engineering. Providence, Rhode Island, Grinnell, Co., c1951. 223 pp., illus., $12.00.

The purpose of the compilers has been to assemble in a single publication scattered information that would be useful to engineers engaged in the design and application of pressure piping systems. To this they have added considerable material never previously published. The main chapters deal with expansion and stresses, velocity and pressure drop, piping materials, pipe fabrication, pipe hangers and supports. Enclosed are forty pages of general tables on temperatures, loads, properties, etc. A bibliography lists books and periodicals concerned with piping, in each case giving the full address of the publisher. This work contains many illustrative diagrams.

Press tool practice, part four. P. S. Houghton. London, Chapman, Toronto, British book service, 1951. 257 pp., illus., $4.25.

The aim of the present work has been to deal with the subject in a practical way and to give as much aid as is possible to the craftsman in a small shop. It is planned to cover each phase of press tool practice, and thus deals with the work done on all classes of hand and power presses, single and double-action. The operations discussed include blanking, bending, cupping, clipping, drawing, forming and raising. Moreover, the use of kindred machinery, such as drop stamps, screw presses, trimming and beading machines, capstan lathes and thread rolling machines are dealt with. No attempt is made to include multi-stage tooling. Toward the end of the work, the actual production of a number of articles by means of the press from sheet or strip metal is discussed. Included are tables, a glossary, and a series of questions and problems.

Principle of relativity: a collection of original memoirs on the special and general theory of relativity. H. A. Lorentz, A. Einstein, H. Minkowski and H. Weyl. New York, Dover, 1923. 216 pp., paper, $1.50.

These translations have been made from a text published in a German collection

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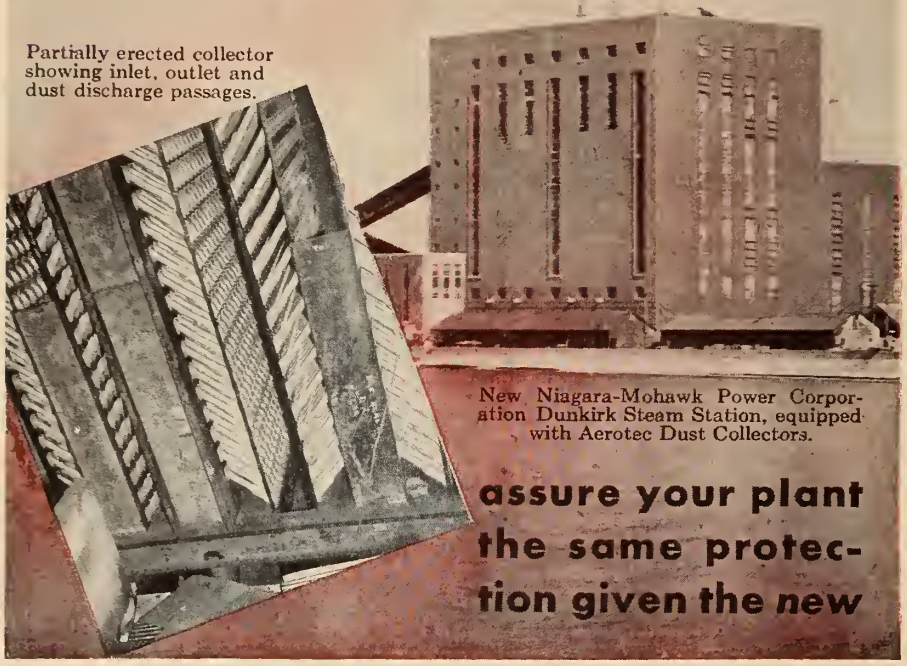

Partially erected collector showing inlet, outlet and dust discharge passages.

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in 1922. The first two papers are by Lorentz. They deal with Michelson's interference experiment and with the electromagnetic phenomena in a system moving with any velocity inferior to that of light. A second and a third paper are written by Einstein and are entitled "On the electrodynamics of moving bodies" and "Does the inertia of a body depend upon its energy content?" The fifth paper, by Minkowski, is concerned with space and time and is followed by a commentary by Sommerfeld. Five other papers, by Einstein, are respectively entitled "On the influence of gravitation on the propagation of light", "The foundation of the general theory of relativity", "Hamilton's principles and the general theory of relativity", "Cosmological considerations on the general theory of relativity" and "Do gravitational fields play an essential part in the structure of the elementary particles of matter". The closing paper is by Weyl and deals with gravitation and electricity. The regular clothbound edition of this book is available at $3.50. This is another title in the new Dover experiment of publishing technical books in paper binding. Your attention is drawn to a reference to this in another part of these book notes.

Structural and mechanical properties of metals. Bruce Chalmers. London, Chapman, Toronto, British book service, 1951. 132 pp., illus., 75c. (Vol. 2 of a series of monographs on metallic materials).

This is the second volume in a series issued under the authority of the Royal Aeronautical Society, and is intended to give a simple picture of the structure of metals and alloys in its relation to the mechanical properties. After describing the structural build-up of the metal, the process of mechanical deformation is described and the effects of deformation and of heat treatment are considered. A brief account of the ways in which a structure can be examined and determined is also given. This work is not intended as a reference book, but rather as an introduction to the subject for students of metallurgy. It is illustrated through diagrams and photographs, and contains a detailed index.

Viscosity and plasticity. E. N. da C. Andrade. Brooklyn, Chemical Publishing Co., 1951. 82 pp., illus., $2.70.

This is a series of three postgraduate lectures delivered in the University of London, to technologists from industries served by the Oil and Colour Chemists' Association. The first lecture is entitled "Nature and theories of liquid viscosity", the second "The flow of simple liquids, suspensions and gels", and the third "The flow of solids". The author tries to show how general principles may be sought and which can be established, and endeavours to indicate how, from these principles, an understanding of the very complex behaviour of flowing liquids and solids may be built up. The book is indexed and illustrated with diagrams and a few micro-photographs.

Welding of non-ferrous metals. E. G. West. London, Chapman, 1951. 553 pp., illus., 55/-.

This book has been written with two main classes of reader in view: the welding engineer, welding operator, welding instructor and trainee on the one hand, and the designer, works engineer and metallurgist on the other. There is no attempt to deal in detail with all the welding pro-

cesses, such knowledge being acquired through actual welding experience. However, in order to assist the reader new to welding, brief descriptions of the processes and equipment are included. For those who wish to delve deeper in the many aspects of the subject, a very long list of references to original papers has been included. Brief explanations have been introduced, whenever necessary, to explain the metallurgical, physical or chemical phenomena encountered in welding. The reader will appreciate the detailed index.

World almanac and book of facts for 1952. Harry Hansen ed. New York, World Telegram and Sun, 1952. 912 pp., $1.30.

In this volume, the international and general information covers, among other things, the war in Korea, British elections, foreign aid from the U.S., personalities, United Nations and religion. The bulk of the book, however, is concerned with the United States and includes a list of members of the eighty-second Congress and report of their work, a federal income tax summary, lists of governors, mayors and city managers, a list of associations and sport performance statistics. It contains information on national defense, developments in atomic energy, education, production, manufacture, trade, finance and federal laws. Population figures for incorporated agglomerations of over 2,500 inhabitants are given.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

D.C. power systems for aircraft. R. H. Kaufmann and H. J. Finison, New York, Wiley, 1952. 206 pp., illus., $6.00.

Aircraft power systems are studied from the viewpoint of how the individual electrical devices work together to make up the complex system now necessary. Based both on theoretical analysis and on actual flight tests, the characteristics and performance of generators, storage batteries, control equipment, and circuits are analyzed and discussed. Circuit-protection methods and the practical application of system protection are covered in considerable detail.

Displacement method of frame analysis. G. P. Manning. London, Concrete Publications, 1952. 120 pp., illus., 9/-.

This book describes the method of frame analysis used in practice by the author for fifteen years, and which enables numerical solutions to be obtained generally with sufficient accuracy by the use of a slide-rule. The method is applicable to continuous beams and frames of any shape, whether subjected to sway or not. Examples are given of a design of a number of types of structures, and tables give the factors for a variety of members. Diagrams are freely used to illustrate the method of analysis.

Practical photogrammetry. H. O. Sharp. Toronto, Macmillan, c1951. 229 pp., illus., $3.75.

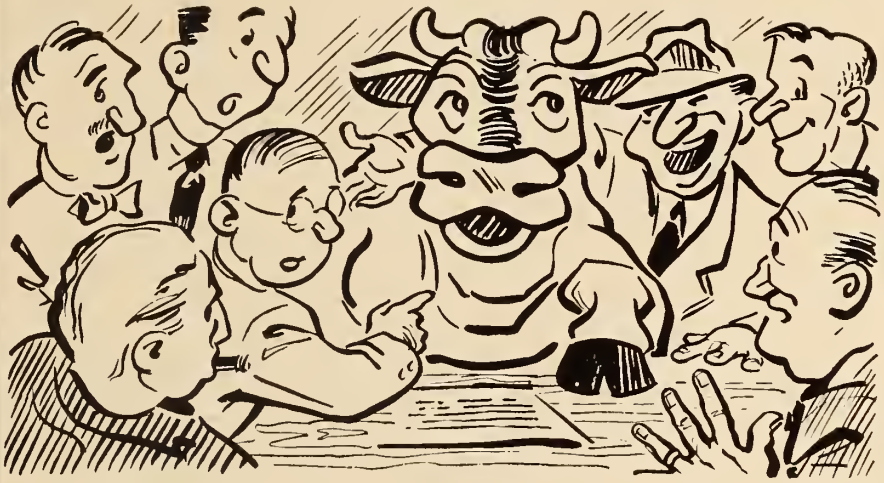
The first part of this small volume deals with fundamental theories, equipment, and methods used in both terrestrial and aerial photographic surveying. Part II is devoted to practical applications, with suggestions as to the proper scales to use for different types of projects. An important aspect is the detailed descriptions for the use of a stereoscope and a stereocomparagraph.

Reviews of petroleum technology. George Sell, editor. Volume II (covering 1949). London, Institute of Petroleum. 280 pp., 27/6.

The subjects covered in this extensive literature survey are as follows: petroleum geology, geophysics, drilling and production, chemical and physical refining, cracking and other processes, plant instrumentation, chemistry and physics of petroleum, analysis and testing, crude oils, petroleum gases, gasoline, fuel and insulating oils, bitumen, synthetic fuels, statistics. Some 3,000 literature references are given along with the respective chapters. There is an alphabetical name index to the literature references.

Tractors and their power units. E. L. Barger and others. New York, Wiley, 1952. 496 pp., illus., $7.80.

Intended both as a college text and as a reference work for the practical man, this book covers the principles of the internal-combustion engine, tractor fuels, the special characteristics of the tractor



THE COW
at the council table

The Reeve and Council were startled, but Jim explained.

"Lactic acid from spilled milk is playing heck with my barn floor. I've brought Bessie along to bear me out."

"Moo-oo-oo!" said Bessie, meaning "You're darn right."
"Battery acid is doing the same to my floor,"
said Bob Harris, the garage owner.

It turned out that Tom Black, the photographer, Bill Short of the cooperative packing plant, Harry Smith, the laundry proprietor, Elmer Park of the sheet metal works, were all having acid trouble, too.

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"Moo-oo-oo!" said Bessie, meaning "You bet your life!"

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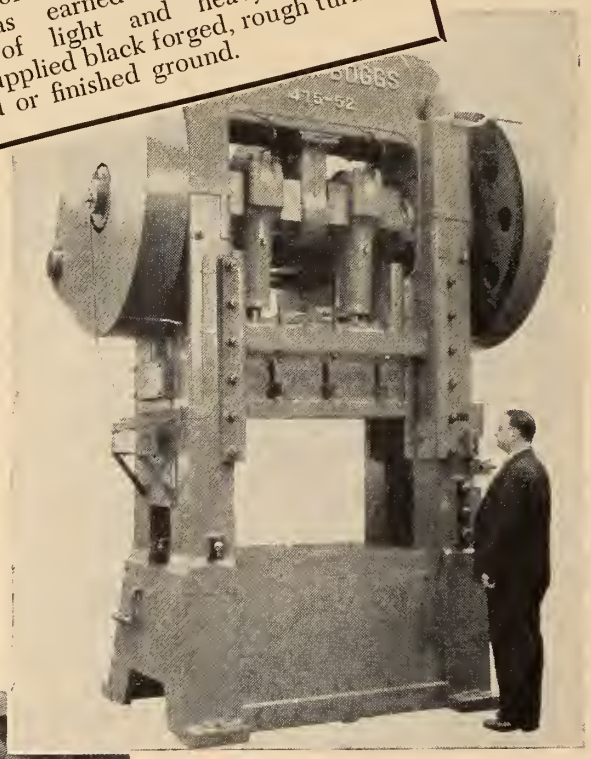

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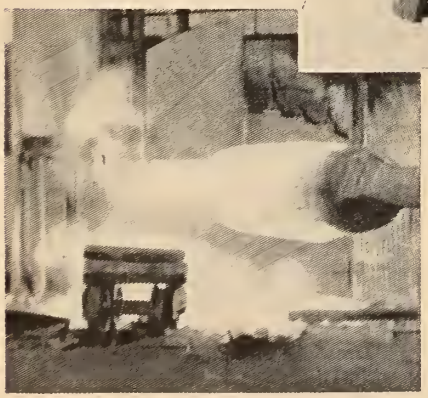

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power unit, the mechanics of the chassis, and the auxiliary elements involved. Tractor tests and performance, maintenance and repair, and power cost estimating are also discussed. A chapter is devoted to the operator's comfort, convenience and safety.

TECHNICAL BULLETINS RECEIVED

Canada. Department of Mines and Technical Surveys. Mines branch. Memorandum series:

No. 117—Preliminary report on coated lightweight concrete aggregate from Canadian clays and shales. Part 1: Alberta, by J. G. Matthews.

. . . Summary of activities:

Summary of activities in 1951.

Canada. National Research Council. Division of building research. Bibliographies:

No. 1—A bibliography on snow and ice, compiled by D. C. Pearce.

. . . Research papers:

No. 2—An investigation of the corrosion of domestic hot water tanks, by P. J. Sereda and others. No. 3—A study of vibrations produced in structures by heavy vehicles, by H. B. Sutherland.

Harvard university. Publications from the department of engineering (Reprints from other publications):

No. 501—Viscosity and density of lubricating oils from 0 to 150,000 Psig and 32 to 425 F, by Donald Bradbury and others. No. 502—The behaviour at infinity of the potential function of a two dimensional subsonic compressible flow, by G. S. S. Ludford. No. 503—The classification of one-dimensional flows and the general shock problem of a compressible, viscous, heat-conducting fluid, by G. S. Ludford. No. 504—An integrating water sampler, by H. A. Thomas and others. No. 505—The desalting of saline waters: a review of the present status, by Edward Moore. No. 506—Studies on Anopheline larvae, by S. L. Chang, G. M. Fair and others.

Illinois University. Engineering experiment station. Bulletin series:

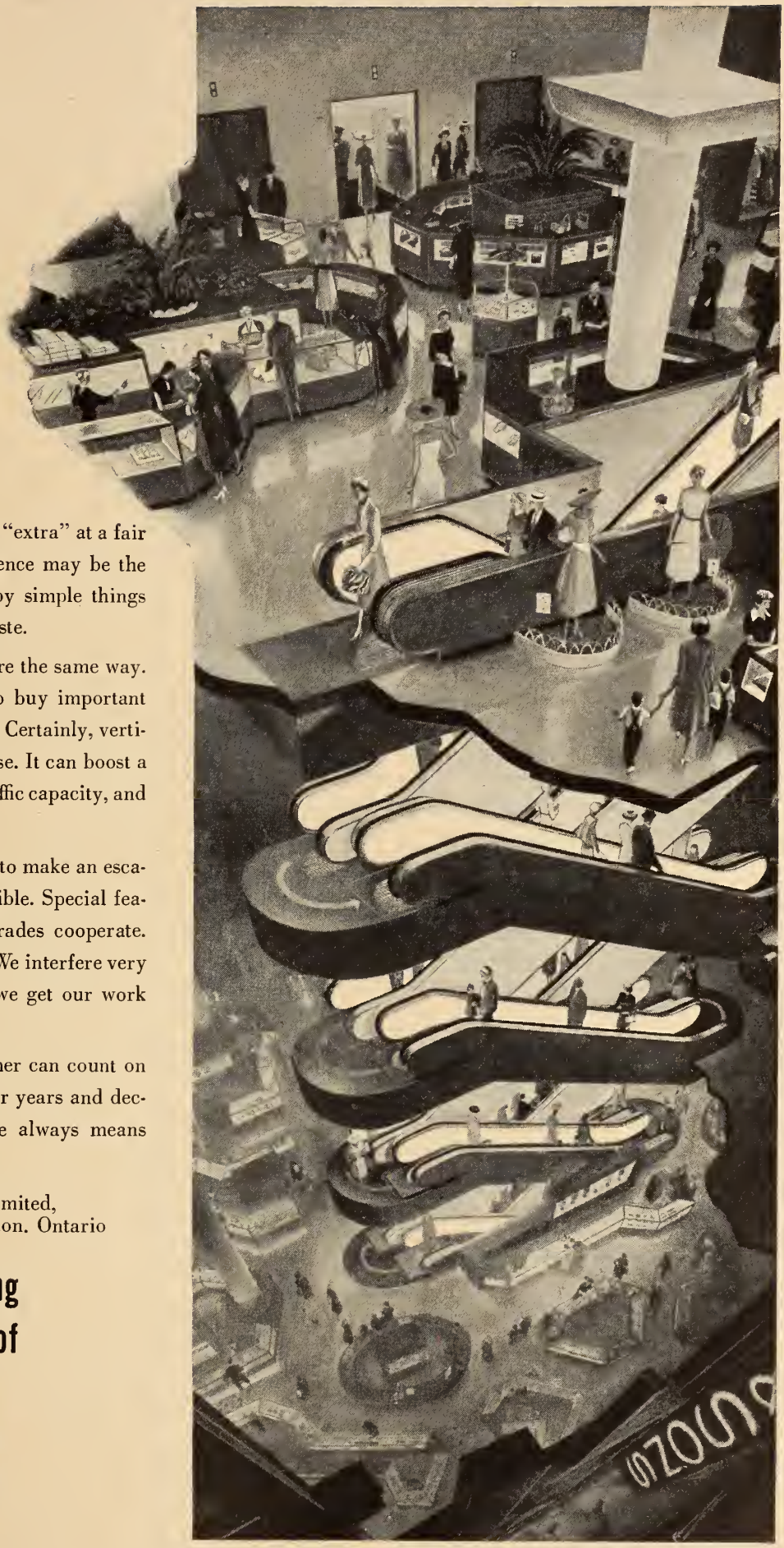
No. 338—Influence charts for computation of stresses in elastic foundations, by N. M. Newmark. No. 393—Investigation of the pressure characteristics and air distribution in box-type plenums for air-conditioning duct systems, by S. F. Gilman and others. No. 396—Studies of slab and beam highway bridges; part 3: Small-scale tests of shear connectors and composite T-beams, by C. P. Siess and others. No. 397—Performance of a gas-fired forced-air heating system in research residence No. 1, by Seichi Konzo and others.

Royal Institute of Technology, Stockholm. Transactions:

No. 57—Transmission of shock waves in thin-walled cylindrical tubes, by F.I.N. Niordson.

Royal Swedish Academy of Engineering Science. Acta polytechnica.

What brings customers back again?



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Chemistry including metallurgy series:

No. 90—Studies on the production of strong phosphoric acid according to the wet anhydrite process, by Sven Nordengren. No. 95—Tall oil refining, by Ake Linder.

. . . Mechanical engineering series:

No. 96—Dynamic capacity of roller bearings, by G. Lundberg and A. Palmgren.

. . . Electrical Engineering series:

No. 97—Theory and applications of wave vectors, by Fredrik Dahlgren. No. 98—An integrating amplifier for the oscillographic recording of magnetic flux, by S. Ekelof and others.

United States Department of Commerce. National bureau of standards. Building materials and structures reports:

No. 126—Self-siphonage of fixture traps.

BOOKS RECEIVED

Advantages of the gray iron casting process and products. C. O. Burgess. Cleveland, Gray Iron Founders' Society, c1951. 28 pp., illus., $1.50.

Aircraft fabrication. 15 pamphlets. International Textbook Co. Scranton, Penn., the company, c1943. Illus., $20.55.

Brans' Vade-Mecum, 9th ed., 1952. P. H. Brans, Ltd. Antwerp, Philips' Gloeilampenfabrieken, c1952. 416 pp., illus., $5.00.

Building construction cost data, 10th ed. R. S. Means. Duxbury, Mass., R. S. Means, c1952. $3.30.

Design of insulated buildings for various climates. T. S. Rogers and others. New York, Architectural record (F. W. Dodge Corp.), c1951. 119 pp., illus., $6.60.

Farm Power. B. D. Moses and K. R. Frost. New York, Wiley, c1952. 484 pp., illus., $6.90.

Fluid flow in pipes. C. H. McClain. New York, Industrial Press, c1952. 123 pp., illus., $3.60.

Great Lakes — St. Lawrence deep waterway. G. A. Lindsay. Ottawa, Department of transport, General engineering branch, 1949. 31 pp., maps.

Heating, ventilating, air conditioning guide, 30th ed., 1952. American Society of Heating and Ventilating Engineers. New York, The Society, 1952. 1,496 pp., illus., $9.00.

Industrial magnetic testing. N. F. Astbury. London, Institute of Physics, 1952. 132 pp., illus., 25/-. (Institute of Physics' series of monographs "Physics in industry").

New approach to engineering tolerances: a critical presentation of the considerations necessary for the allocation and maintenance of realistic tolerances in modern economic production. J. Gilson. London, Machinery Publishing Co., c1951. 99 pp., illus., 10/6.

Radio amateurs' handbook, 29th ed. American Radio Relay League. West Hartford, Conn., The League, 1952. 549 pp., illus., $3.50.

Rise of the new physics: its mathematical and physical theories (formerly titled "Decline of mechanism"). 2nd ed. 2 vols. A. D'Abro. New York, Dover, c1951. 982 pp., illus. $9.60.

"The Engineer" directory and buyers' guide, 1952. London, The Engineer, 1952. 440 pp., illus., 5/-.

Treatise on milling and milling machines, 3rd ed. Cincinnati Milling Machine Co. Cincinnati, The Company, 1951. 910 pp., illus., $9.60.

Westinghouse architects' and engineers' electrical data book. 2nd rev. ed. Canadian Westinghouse Co. Hamilton, The Company, 1952. 330 pp., illus., $5.00.

Westinghouse hospital electrical planning for architects and engineers. Canadian Westinghouse Co. Hamilton, The Company, 1952. 238 pp., illus.

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Put Typhonite Eldorado Pencils to the test, won't you? Try them for yourself. Typhonite leads are exclusive with Dixon so no other pencil can be like Typhonite Eldorado.

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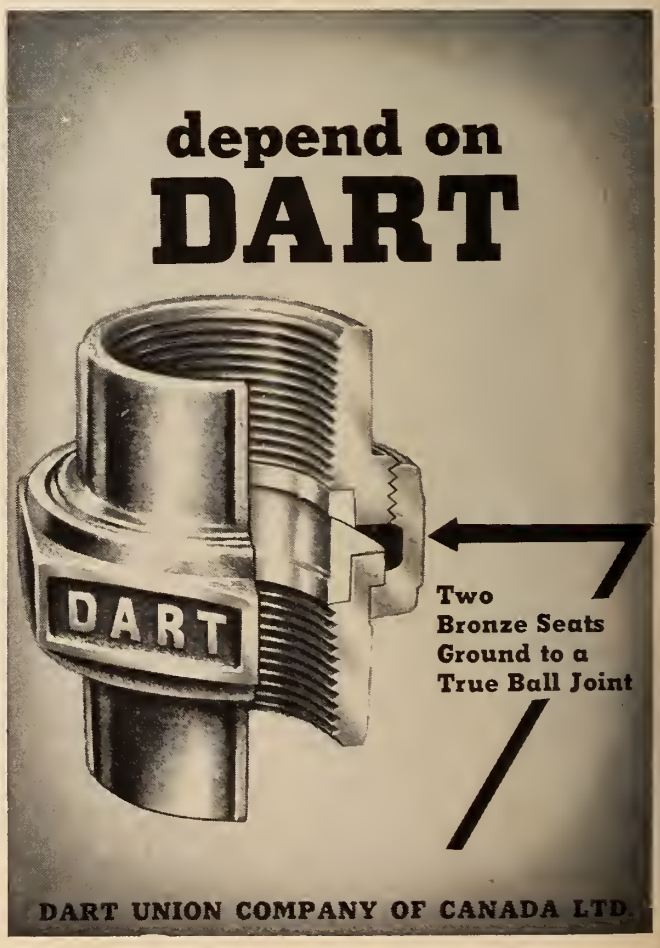
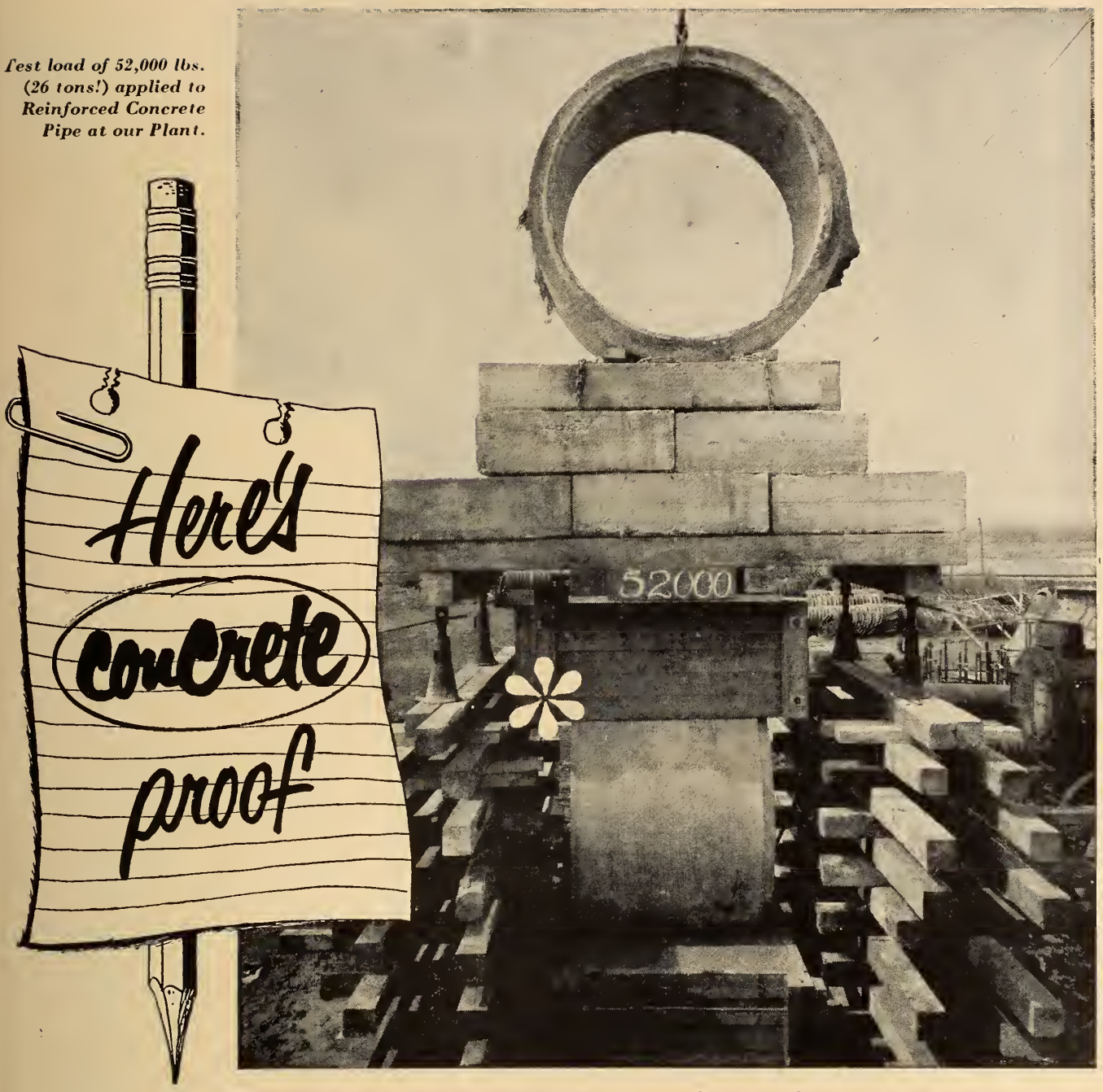
Just send us your name and address, and tell us the degree of Dixon's Typhonite Eldorado Pencil you would like to try.

Order Dixon's Typhonite Eldorado Pencils from your regular source of supply

DIXON PENCIL CO. LIMITED, NEWMARKET, CANADA



Test load of 52,000 lbs. (26 tons!) applied to Reinforced Concrete Pipe at our Plant.



That we are prepared to demonstrate the quality of our pipe by tests

Our pipe are manufactured to meet the specifications of the American Society for Testing Materials, and a regular test programme ensures the uniform quality and strength of pipe that is necessary for it to carry the loads imposed on it under the varying conditions of sewer design.

CPL 5102

CONCRETE PIPE LIMITED

HEAD OFFICE: 1500 GLENCAIRN AVE., BOX 7, FAIRBANK P.O., TORONTO 10, ONTARIO
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MANUFACTURERS OF: PIPE FOR STORM AND SANITARY SEWERS • HIGHWAY CULVERTS AND SUBWAYS • RAILWAY CULVERTS AND UNDERPASSES
INDUSTRIAL PLANT STORM DRAINAGE • TOWNSHIP DRAINAGE SYSTEMS

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information received by

The Editor

New Equipment and Developments

Chart Controller. — An electronically operated chart controller which can control industrial processes according to time-temperature schedules has been developed by Minneapolis - Honeywell Regulator Company.

In instances where both time and temperature control are important for product quality and efficiency of operation, the new instrument, developed by Honeywell's Brown Instruments Division —has an integral program cam mechanism which automatically positions the instrument control point in accordance with a pre-determined program.

The instrument combines within a single case, measurement and recording on a 12 inch chart; automatic positioning of the set point index as directed by a transparent program cam; and automatic program control of the variable.

For complete information write to the Minneapolis-Honeywell Regulator Company Limited, Toronto.

•

C.I.R. Stationary Air Compressor.—A new stationary air compressor for industry, which combines small dimensions with large work capacity has just been developed by Canadian Ingersoll-Rand Company Limited, Montreal. The "Air-Pac", which is the name given to this new power unit by the manufacturers, is a small, compact compressor with a capacity suitable for small manufacturing plants and service shops. It is also suitable for use in larger plants where it may be economical to decentralize the air supply or provide air capacity in isolated sections of the plant.

The "Air-Pac" will operate several pneumatic tools such as chippers, drills, grinders, screw-drivers, or sand blasters and paint spray apparatus, or a number of pneumatic cylinders, air chucks and vises. The low power requirements of the "Air-Pac" keep operating costs at a minimum.

Automatic control is another feature of the "Air-Pac". It is controlled by the air demand so that the compressor operates only when required. The "Air-Pac" is air-cooled for efficient, continuous operation, a feature which eliminates troubles and the continuing cost of providing cooling water. Compact in design, this new compressor will fit small space requirements and it is easy to install. Attendance and maintenance are reduced to a minimum. For further information about this product, write to: Canadian Ingersoll-Rand Co. Ltd., 620 Cathcart St., Montreal, Quebec.

•

Surface Resistance Indicator.—A new portable surface-resistance indicator, designed to help produce a better resistance welding bond by providing a rapid and accurate measurement of the resistance between pieces of metal to be welded, is available from the Special Products Section, Canadian General Electric Company, 212 King Street West, Toronto.

The instrument supplies a simple check on pre-welding cleaning processes, upon which surface resistance of the metal depends. It consists of two parts, a microhmeter and a sample holder. The unit has two ranges: 0-200 and 0-2000 microhms. The measured resistance is indicated directly in microhms on a linear 100 division scale. Voltage fluctuations in the supply mains do not affect the reading.

For complete details communicate with the Company.

•

Concrete Slabs. — Murray Associates Limited, Richvale, Ontario, are now manufacturing Flexicore precast concrete slabs. During the first year of operation the company plans to produce 100,000 square feet of slab.

Flexicore catalogues and erection literature can be obtained by writing to Murray Associates Limited, Richvale, Ontario.

•

Halifax-Dartmouth Bridge.—Dominion Bridge Company Limited have been awarded the contract for the fabrication and erection of the superstructure of a suspension bridge for the Halifax-Dartmouth Bridge Commission.

The bridge, to be erected across Halifax harbour, will have a total length of 4,420 ft. between faces of abutment back walls. The main span between towers will be 1,447 ft. 2 in. and the side spans 526 ft. 7 in. The height of the towers will be 309 feet, and the clearance under the main span 165 ft. The total weight of the steel work will be approximately 8,200 tons.

The new bridge will be slightly shorter than the Lion's Gate Bridge, Vancouver (also fabricated and erected by Dominion Bridge) which is the largest of its type in the British Empire.

P. L. Pratley, D.ENG., M.E.I.C., of Montreal is the Consulting Engineer for the Halifax project with C. A. Fowler & Company of Halifax, associate engineers.

Completion of the entire $8 million project is scheduled for 1954.

•

Canadian Electricity Consumption. — According to information given by Robert H. Saunders, Chairman of the Hydro-Electric Power Commission of Ontario, Canada is now using more hydro-electric power per capita than any other nation in the world with the exception of Norway.

In a comparative survey of U.S. and Canada hydro requirements, Mr. Saunders pointed out that Canadians consume 3,928 kilowatt hours per capita annually, while the U.S. annual per capita consumption totals 2,414 kilowatt hours.

Since 1939, Canada has increased its industrial output by more than 415 per cent—a rate unexcelled by any other country in the world.

The hydro development pace has, within 13 years, completely changed the industrial face of Canada. In the year 1900, Canada used only one horsepower per person. Today, we consume 37 horsepower per person.

Mr. Saunders said "If we translated the electrical energy produced in Canada into kilowatt hours, the total is 57-million, 400-thousand. This means electricity is doing the work that would be required by 294-million Canadian workers."

•

Mercury-Vapour Detectors.—Two completely redesigned portable mercury-vapour detectors—the Type A (Electronic) and the Type B (Chemical)—for indicating concentrations of mercury which could be harmful to industrial workers, are available from the Special Products Section of Canadian General Electric Company.

The new detectors are expected to be used widely by manufacturers of electrical apparatus, instruments, bulbs and glassware, fur, salt, rubber; and by the chemical, metal mining, and smelting industries. The lighter, more compact instruments will also prove helpful to insurance companies, public health departments, and laboratories.

Complete details may be obtained from the Company. Write to 212 King St. W., Toronto 1.

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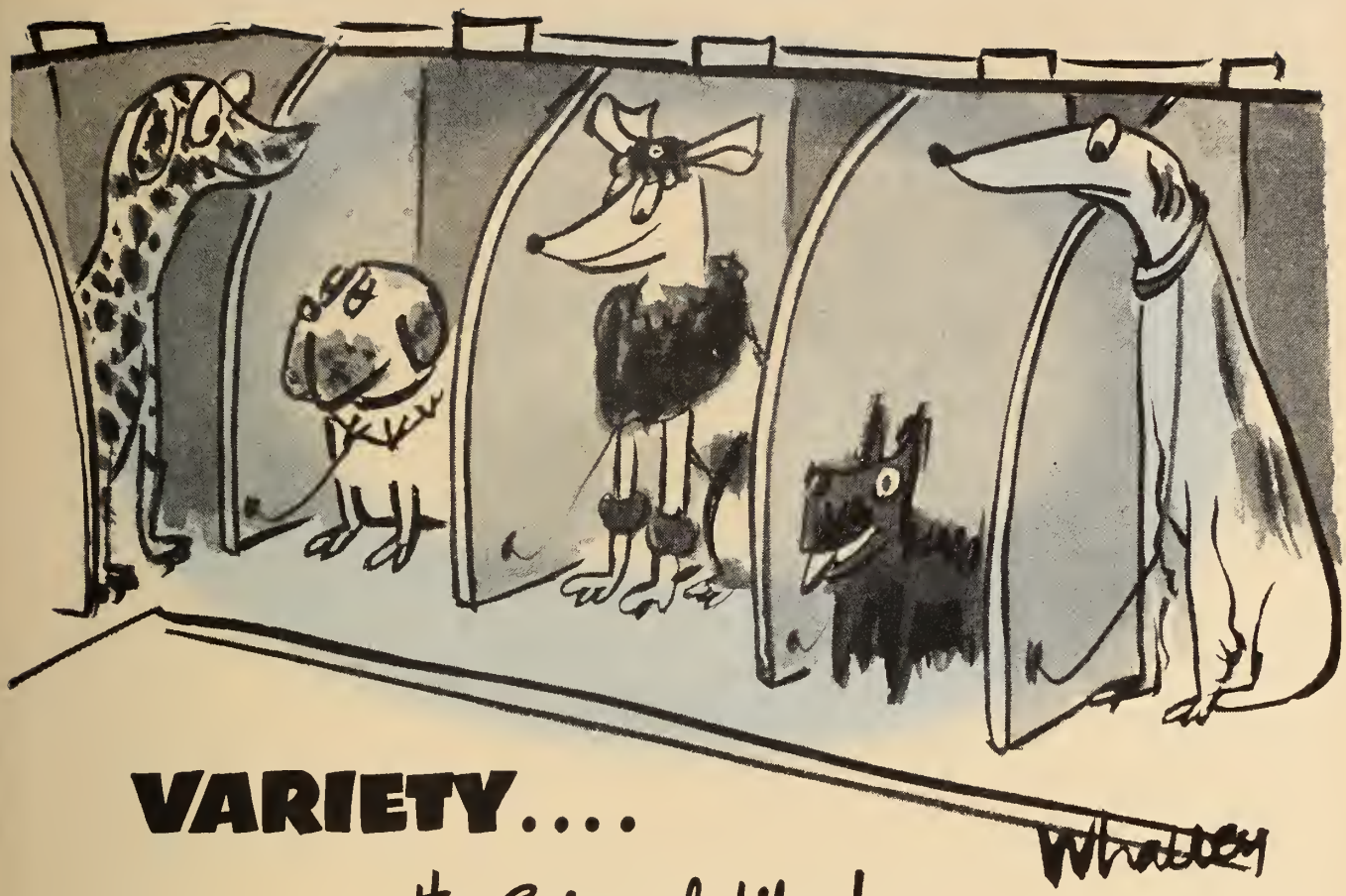


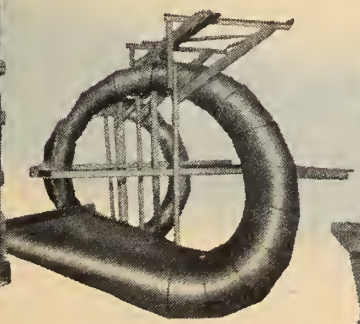
VARIETY....

the Spice of Life !

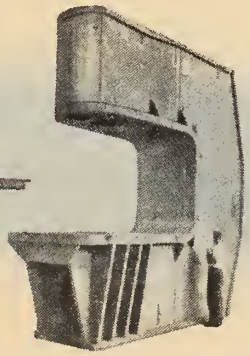
IN our Platework division—as in dog shows—it's hard to find two "animals" just alike; but that's what makes the work so interesting! Variety is the keynote at Dominion Bridge and our ability to solve unusual problems is of the greatest value to customers in practically every industry.

May we send you our booklet PF-100 "PLATEWORK FOR EVERY INDUSTRY"?

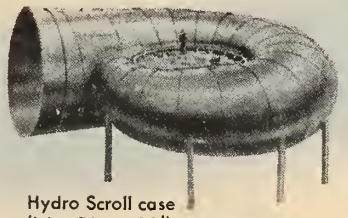
Towers far Polymer Corp. larger one 165'—4" high)



Spiral chute for coal briquettes



Large Press Frame (Weight 60 tans)



Hydro Scroll case (Inlet Diam. 22')

Digester for Paper Mill (48' high)

PLATEWORK DIVISION * DOMINION BRIDGE COMPANY LIMITED

*OTHER DIVISIONS: BOILER • STRUCTURAL • MECHANICAL • WAREHOUSE

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Assoc. Companies at: EDMONTON, SAULT STE. MARIE, QUEBEC, AMHERST.

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LEITZ PRECISION has become world-famous during the course of its hundred years' tradition. Like LEITZ microscopes, measuring instruments, or the universally-known Leica Miniature Camera, the LEITZ prism glasses are also

TOP QUALITY PRODUCTS

Walter A. Carveth Limited

431 YONGE STREET • TORONTO

C.P.R. Progress.—W. A. Mather, president of the Canadian Pacific Railway told the shareholders of the company at the 71st annual general meeting that the development of Canada had "caught up with railway construction." He urged that the railways "be placed in a position to finance their requirements of capital on a sound basis."

"The railway systems of Canada were built, in large part, in anticipation of the traffic needs of the country," he continued. "Railway mileage is no longer in excess of needs. The development of Canada has, in fact, caught up with railway construction."

Commenting on the Company's activities during the last year, Mr. Mather said, "last year, more than 90,000 employees in Canada were on the payrolls. In addition employment was provided for the vast numbers engaged in the production of the goods and services purchased by the company. In 1951 total purchases made by the company exceeded $192 million. Of this amount $174.2 million was bought in Canada."

•

G. M. Diesels.—An important milestone in the rapidly expanding activities of the Diesel Engine Sales Division of General Motors Products of Canada was reached on May 1st when the Division was moved from Oshawa to General Motors Diesel Limited, London, Ontario.

The transfer is in keeping with the long range policy of combining Canadian sales and distribution of G.M. Diesel Products at the big, modern plant of General Motors Diesel Limited, which, in less than two years, has built some 250 locomotives for 12 Canadian customers including 11 railroads.

Under Norman H. Daniel, manager of the Diesel Engine Sales Division at Oshawa, the entire staff of 15 persons has been assigned to General Motors Diesel Limited. It includes Russell Gage, sales manager of the Division, R. William McEachran, Parts and Service Manager; and a field force including district sales managers at Vancouver, Edmonton, Toronto, Cornwall, Montreal and Moncton, N.B.

•

English Electric Expansion. — A five-year expansion program, entailing the expenditure of $1,250,000 in the first two years, has been announced by the English Electric Company of Canada Limited at St. Catharines.

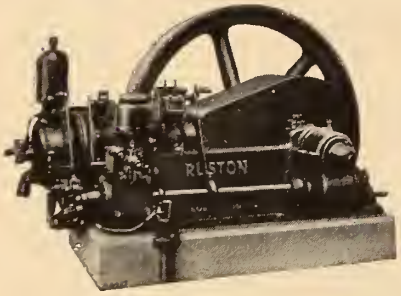
First step in the program will be a $400,000 addition to the Company's present transformer bay. The new building, the cost of which covers construction and capital equipment, will add 20,000 square feet to the bay. It is expected that it will be ready for operation by January 1, 1953.

The remainder of the money to be spent during the initial two year phase will go towards rehabilitation and modernization of existing manufacturing facilities.

Further construction to be undertaken during the five years will all be on the Company's present site in St. Catharines. The last major addition to the plant was the large transformer bay, in 1941.

•

these engines mean business



These Ruston engines cannot be bettered for efficiency and trouble-free service. The horizontal type is the good old standard, respected for years for 'slogging' stationary work. And the transportable units, from 5 to 250 horsepower, have the same high standard of daily reliability.

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DIESEL POWER FOR THE GO AHEAD USER

CANADIAN DISTRIBUTORS

MONTREAL & TORONTO : *Laurie & Lamb*
WINNIPEG : *Mumford, Medland Ltd.*
LUNENBURG, N.S. : *Atlantic Bridge Company Ltd.*
EDMONTON : *Electrical Industries Ltd.*
ST. JOHNS, N.F. : *Job Brothers & Co. Ltd*
VANCOUVER : *Vancouver Machinery Depot Ltd*

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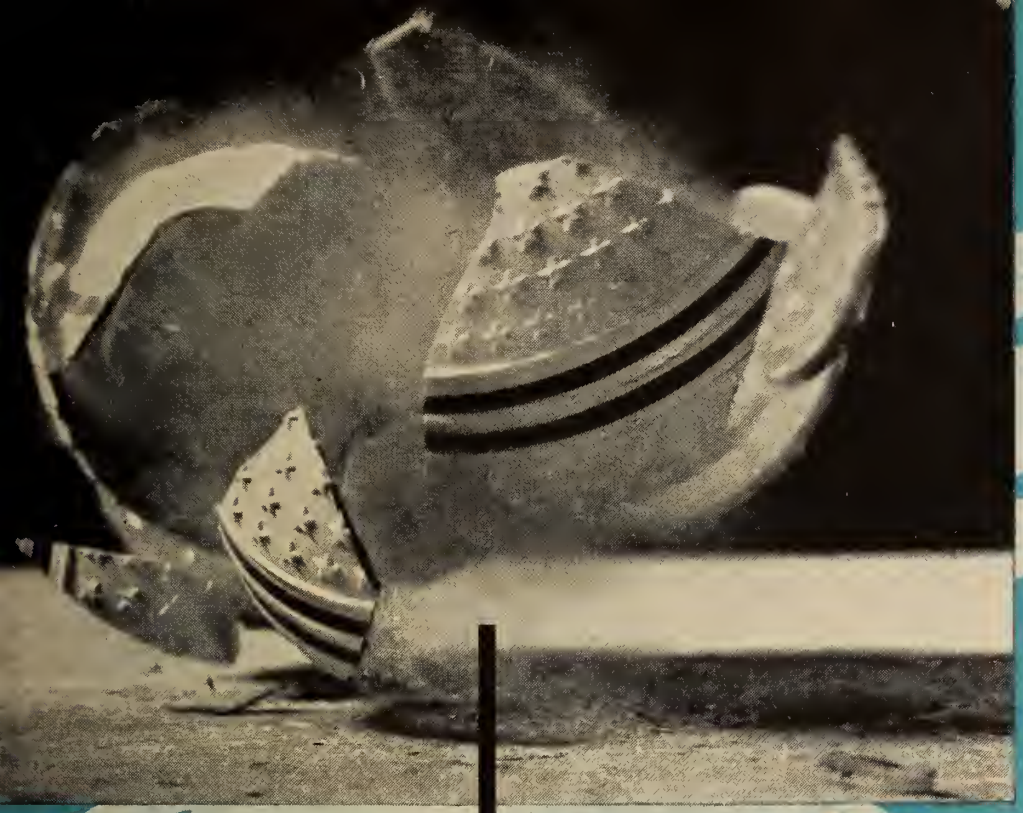

Chilled to—150° F in dry ice, a child's rubber ball loses its bounce, shatters like pottery or a Christmas tree ornament. To take this picture an electronic flash was tripped by microphone at 1.035 milli-seconds after contact.

RUBBER SHATTERS LIKE POTTERY at -150°F — but Nickel steels

RETAIN STRENGTH, TOUGHNESS and DUCTILITY

The child's ball illustrated was chilled to −150°F and allowed to drop to a solid surface before a camera lens. The sub-zero cold encountered in many industrial applications makes natural rubber as rigid as iron, freezes an orange hard enough to hammer nails, makes many metals so brittle as to break with a comparatively slight shock.

What about the industrial applications where materials must retain strength at sub-zero temperatures?

The answer lies in alloying with Nickel. 3½% Nickel Steel remains strong and tough down to −150°F, while 8½% Nickel Steel retains these properties down to −320°F.

If your problem is sub-zero cold—let's talk about it.

EMBLEM OF INCO SERVICE
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED · 25 KING ST. W., TORONTO

Helicopters on Line Patrols.—Ontario Hydro is using four helicopters to streamline their line-patrol activities. Considerable savings in time and money are being effected, through the use of the helicopters, in checking its 6,000 mile network of high-voltage transmission lines. In commenting on the situation, Chairman Robert H. Saunders said that the cost per mile had been cut by almost half by using the air patrols and occasional ground crew inspections. The main saving, he stated, "was in the cost of the housing, trucks and equipment necessary for the original foot and automotive patrols."

"Today," Mr. Saunders stated, "our aircraft range from Cornwall in the extreme east to remote Red Lake in the northwest. In addition to economy we find, in many cases, that a more thorough inspection is possible by this comparatively new method."

Since the inception of this method of powerline inspection in June, 1949, the air patrols have covered over 110,000 miles. During this period the four Hydro pilots have logged approximately 2,541 flying hours. One helicopter with a two-man, pilot-observer crew, can inspect approximately 100 miles of line in 2½ hours. This job would take at least 10 ground patrolmen about two days.

•

Pressure Controller.—A new compact non-indicating pressure controller for regulating control valves has been developed by Minneapolis-Honeywell Regulator Company.

The new device, to be marketed under the name of Honeywell Pressure Pilot, is for use on process systems in the chemical, petroleum, power and other industries where pressure control is essential. The pilot employs a bourdon tube to measure the pressure and a flapper and nozzle arrangement to produce an air signal directly to the valve. The air signal is based on a change in line pressure. The unit may be mounted directly on the control valve or on a wall or panelboard.

The first showing of the new pilot was at the Chemical Show in Montreal at the beginning of this month.

•

New Thompson Products Plant.—Construction is now under way for the new $6,000,000 jet aircraft engine parts plant to be built by Thompson Products Ltd. in Grantham Township, opposite to their present plant, which is situated in St. Catharines, Ontario. The contract for the new plant has been awarded to Newman Brothers of St. Catharines.

The company has entered into a contract with A. V. Roe (Canada) Ltd. for the production of a composite turbine wheel for the Avro Orenda jet engine. This has increased the over-all value of the plant from $5,000,000 to $6,000,000 and will increase employment from 600 to 700 persons for the new division. A major contract has been entered into for the production of jet engine blades for the British Sapphire engine being made for the Buick Co. in the United States under the joint international agreement for the United States Air Force.

•

New Dominion Oxygen Plant.—Dominion Oxygen Company Limited has purchased approximately 10 acres of land in the Strathcona district of Edmonton for a new oxygen and acetylene plant.

The proposed plant site is in the heart of the growing oil and chemical industrial area of Edmonton. As yet, no details about the type or capacity of plant or construction dates are available.

•

Manufacturing Opportunity.—A very long established firm of Construction Engineers — manufacturing a complete range of Centrifugal Pumps, Rammers, Concrete Vibrating Equipment, Portable and Fixed Conveyors—intend to manufacture their complete range of thirty machines in Canada. This British concern is desirous of contacting selling organizations (or individuals) covering the various provinces of Canada who have an established connection with construction engineers, coal mines, quarries, city engineers, gas works, etc. Interested readers are invited to write to Baird & Dawson Advertising Agency, Old Colony House, South King St., Manchester 2, England. Envelopes and letters should be marked "Construction Engineers". All replies will be treated with strict confidence.

•

New Fiberglas Plant.—A new industry was launched in Guelph, Ontario, in May

COGHLIN SPRINGS

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We manufacture all kinds of Springs, large and small, for every purpose.

Our eighty-three years' experience is your guarantee of superior quality and workmanship.

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Guard against costly loss of travel funds . . . Canadian Pacific Express Travellers Cheques are good only with your signature—if lost before being countersigned your money is refunded. Obtainable from all Canadian Pacific agents and most banks.

always carry CANADIAN PACIFIC EXPRESS TRAVELLERS CHEQUES

with the official opening of a Fiberglas Canada Limited textile plant costing close to $2,000,000. Company officials say this is part of an expansion program that has continued almost since Fiberglas was first produced in Canada in 1941.

This move completes the transfer of the company's expanding textile division from Oshawa to Guelph. Operations at the Oshawa plant will now concentrate on the production of Fiberglas products for the oil, automotive and aircraft industries. The Sarnia plant, which was opened in December 1948, produces Fiberglas insulation products for such applications as roofs, buildings, refrigerators, stoves, etc.

The new plant has an area of 58,978 square feet and it employs 175 persons. Although no additional expansion is contemplated immediately the company has another 92,944 square feet of property in the Guelph district for use when required.

•

First Manufacturing Plant in Kitimat. An oxygen and acetylene plant of the Canadian Liquid Air Company will be the first manufacturing plant at Kitimat, B.C., it has been announced by L.A. officials. When the huge aluminum and hydro-electric development of the Aluminum Company of Canada at Kitimat was commenced last year, it was forecast by the Hon. E. T. Kenney, Minister of Lands and Forests, B.C., that other industries would be attracted to the Kitimat site. This forecast has been justified within a year.

Kitimat will make the 18th Liquid Air plant in a network that covers all the industrial centres of Canada from Newfoundland to B.C. Erecting this new plant is in keeping with the pioneering efforts of Canadian Liquid Air, which has been closely identified with the industrial progress of Canada for over forty years. During that time, this company has been credited with an impressive number of "firsts" both in the erection of oxygen plants and the development and promotion of the oxy-acetylene and other processes widely used throughout industry.

It is expected that this new L.A. plant will not only assist in the initial building up of the Kitimat development, in view of the importance of welding and associated processes in modern fabrication and maintenance work, but also will eventually serve lumbering, mining, paper and other industries and welding shops in the region around Kitimat.

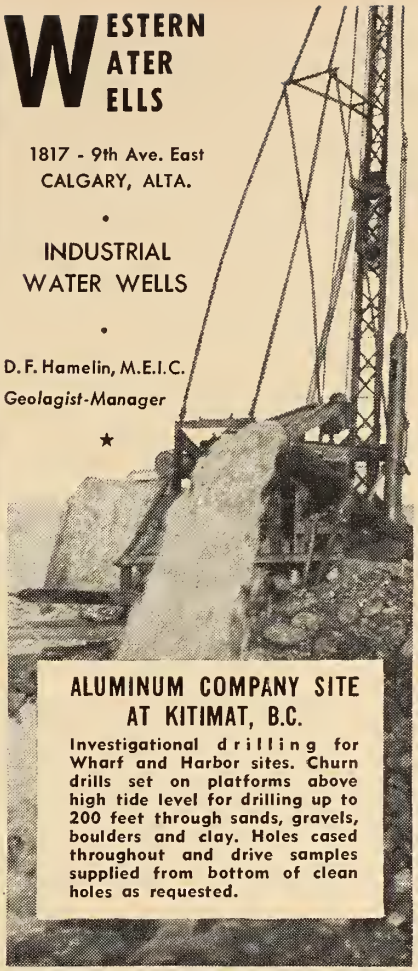
•

Scrap Iron Drive.—In registering the Government's complete accord with the aims of a scrap-drive organized by the steel industry through their Canadian Scrap Iron and Steel Committee to increase the supply of ferrous scrap, the Rt. Hon. C. D. Howe, Minister of Defence Production has released the following statement:

"There is no question but that our iron and steel industry will need a great deal more scrap in the near future than it has in the past.

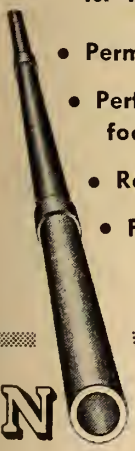
"I would like to congratulate the managements of those iron and steel companies and members of the secondary materials trade who are co-operating in this program on their foresight in tackling this problem now."

(*Continued on page 702 (92)*)



SPECIFY
QUALITY

NO-CO-RODE GIVES A LIFETIME OF TROUBLE-FREE SERVICE
for house-to-sewer and septic tank connections.



- Permanent, root-proof, economical
- Perforated for septic tank beds and footing drains
- Recommended by Health Departments
- Faster, easier to install.

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Designers and Manufacturers of mechanical parts and complete mechanical installations for industry.

TO PROVIDE ARCHITECTS, ENGINEERS AND CONTRACTORS WITH A NEW COMPLETE STRUCTURAL SERVICE . . . . . .

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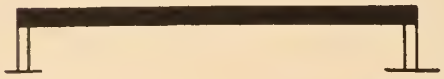

BEAMS

New Head Office location

in a recently renovated building at 640 Cathcart St., Montreal, Que. Telephone number remains the same: UN. 6-9575.

New Branch Office

in Toronto, Ontario, located at 57 Bloor St. W. — Telephone Klngsdale 6683. Under management of Mr. A. J. Petch.

Increased Engineering Staff

to expedite design drawings and engineering details as required by architects, engineers and contractors.

Revised Prices

Discover now how economical your structural requirements can be on the basis of new, lower prices at L.S.L.

New Literature

Please contact the "Laminated Structures" office nearest you for technical data and colourful descriptive literature.

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DESIGNERS AND FABRICATORS OF ENGINEERED WOOD PRODUCTS

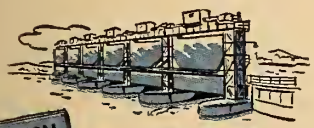
HARNESSING WATERPOWER

Impression of closure gate of the great Des Joachims Power Development of the Ontario Hydro.

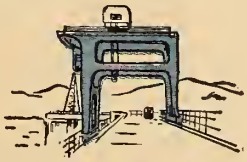
FOR MORE THAN 50 YEARS Dominion Bridge Company has been associated with the task of harnessing water power and during this period has contributed largely to the development of Canada's vast hydro-electric system.

Besides designing and fabricating most of the regulating gate equipment now in use, the Company is the leading manufacturer of overhead and gantry cranes, penstocks, scroll cases, structural steel and many other special items.

DOMINION BRIDGE COMPANY, LIMITED • HEAD OFFICE: LACHINE, QUEBEC

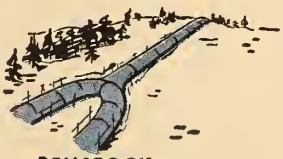


SLUICE GATES



GANTRY CRANE

TAINTER GATE



PENSTOCK

MECHANICAL DIVISION*

*OTHER DIVISIONS: BOILER • STRUCTURAL • PLATEWORK • WAREHOUSE

DOMINION BRIDGE

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 699 (89)*)

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

New Darling Catalogue.—A new catalogue of hot water heating equipment has just been issued by Darling Brothers Limited, Prince Street, Montreal. It gives complete up-to-date specifications of Whitlock-Darling Type "R" U-Tube Convertors and associated equipment such as Darling Class "D" Centrifugal Pumps, Sylphon Temperature Regulators, Webster Float and Thermostatic Drip Traps. Several Canadian installations are described and illustrated. The complete capacity and design tables are made easily readable by the use of horizontal colour bars. The bulletin is available in either French or English. If copies of the English version are required ask for bulletin No. 65 and if the French version is required ask for No. 65-F.

•

"Weather Magic".—Weather magic is the title of a bi-monthly publication issued by Trane Company of Canada Limited. For regular receipt of this interesting publication, write to the Company, Mowat Avenue, at King Street West, Toronto, Ontario.

•

Turnbull Elevator Publication. — Turnbull Elevator Company Limited, 126 John Street, Toronto, are publishers of an interesting periodical "Going Up". This publication describes the various installations made by the company and it outlines the requirements and construction of passenger and industrial type elevating equipment. To receive the publication regularly write to the company at the address given in this item.

•

Bepco Journal.—No. 4 Volume Ten of the Bepco Journal is devoted to a description of the Rapid Transit Cars to be used in Canada's first subway at Toronto. To receive copies of this issue and of subsequent issues, write to Bepco Canada Limited, 4018 St. Catherine St. W., Montreal 6, Quebec.

•

Ball Valve.—A new ¼ inch Ball Valve of unique construction, recommended for working pressures up to 3,000 psi is announced by The Foxboro Company, Foxboro, Mass., Tight, positive shutoff is provided by a stainless steel ball which closes into a machined, conical seat. The ball retained at the end of the stem, is free-rolling so that every closing brings a new surface into contact with the valve seat. Alignment of ball to seat is accurately piloted by a forged, steel union-type bonnet, fitting tightly to the body and assuring a correct valve closure.

The ball valve will be particularly useful on meter manifolds, gauge lines, seal chambers, bleed-off connections, sampling connections and lubricator shutoffs. It is universally adaptable in applications for liquid, gas and steam service. For descriptive literature, write to Peacock Brothers Limited, Ville LaSalle, P.Q.

•

Minneapolis-Honeywell Potentiometer.—The new two-second high speed "Electronik" strip chart potentiometer is described and illustrated in specification sheet No. 179. Operating on the "continuous balance principle", the instrument pen and pointer will travel full scale in two seconds. For complete descriptive literature write to Minneapolis Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont.

•

Link-Belt Booklet.—A new booklet of information on Bulk-Flo conveyors and elevators has just been published by

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Link-Belt Limited. This 28 page Book No. 2475 contains photographs of the Bulk-Flo in a variety of applications, together with typical layout drawings, engineering data, calculation tables, charts and formulae. Over 150 materials are analysed for average weight and such characteristics as size, flowability and abrasiveness. Write to the company for copies; the address is Eastern Avenue at Leslie and Keating Streets, Toronto 8, Ontario.

●

National Building Code. — A proposed Administration Section for the revised National Building Code is now available from the National Research Council, Ottawa 2, Ontario. Like other parts of the Code, this draft has been prepared as a model by-law. It has been written in clear, legal and technical form, and is being widely circulated to come to the attention of all local governments.

This section of the National Building Code will interest those administering local building regulations — it makes it possible to link local factors to the structural safety, fire, and health requirements covered in the remainder of the Code. Address requests to the Secretary, Associate Committee on the National Building Code, National Research Council, Ottawa 2, Ontario.

●

New Wharton Crane Catalogue.—The Wharton Crane & Hoist Co. Ltd. have just completed an excellent catalogue of their products. It supersedes the various leaflets which have been mentioned in the Journal from time to time. Copies of the catalogue are available from the parent company. The Wharton Crane & Hoist Co. Ltd., Reddich, Stockport, England, or from Marshall Equipment Co. Inc., P.O. Box 141, 1360 Greene Avenue, Westmount, Quebec — Mumford, Medland Ltd., 576 Wall Street, Winnipeg or Vancouver Engineering Works Ltd., 519 to 659 West Sixth Ave., Vancouver, B.C.

In a letter which accompanied the sample copy sent to the Editor, it is stated "We have endeavoured to make certain that this publication takes a practical form best suited to assist crane users generally, and we hope that you find the quality of the publication suitable for Canadian distribution." The publication is highly recommended to readers of the *Journal* who are interested in cranes of various types.

●

Insulation for Non-Basement Buildings.—Fiberglas Canada Limited, 50 St. Clair Avenue W., Toronto, have issued two booklets on "Perimeter Insulation". The booklets will be of particular interest to those who are concerned with basementless buildings. For copies write to the company and ask for "The Story of Perimeter Insulation for Standard Heating Systems" and "Perimeter Insulations for Concrete Floor Slabs."

●

New Hamilton Gear Hob List.—Hamilton Gear and Machine Co. Ltd., 950 Dupont Street, Toronto 4, Ont., offer an additional item published in their series of technical data sheets. The subject of the new sheet is "Worm Gearing and Hob List (4) Triple and Higher Multi-thread Hobs". Copies will be forwarded by the manufacturer upon receipt of requests.

●

Design of Power Piping. — Taylor Forge & Pipe Works Inc., Ontario, offer a re-print of an article written by Sabin Crocker on the subject "How to Use Schedule Numbers in Power Piping Design". The article is very informative. Copies may be obtained by writing to the company in Hamilton.

●

Flame Hardening.—Dominion Oxygen Co. Ltd., 40 St. Clair Avenue East, Toronto 5, Ontario, offer a new eight page illustrated booklet "Flame Hardening—A Flexible Method of Surface Treatment". The booklet lists the advantages of flame-hardening, and steel that can be hardened.

●

Plywood Applications. — Plywood Manufacturers Assn. of B.C. offer a well produced pocket size manual designed to supply general information on the properties and methods of application of waterproof-glue Douglas Fir Plywood. The Plywood Manufacturers Assn. of B.C. is presently producing a great deal of technical material which will be of particular interest to engineers. Copies of the booklet mentioned herein and of additional material will be received upon application to the Association at 810 West Hastings St., Vancouver 1, B.C.

●

Appointments and Transfers

Monsanto Purchase. — Monsanto Canada Limited has purchased all the outstanding common stock of Barringham Rubber and Plastics Company Limited, Oakville, Ontario. The Barringham Company will be operated as a subsidiary of Monsanto Canada Limited. In addition to supplying resins for Ultron plastics, Monsanto will provide the Oakville plant with technical assistance for the development of new products in the general field of plastics.

Edward Barringham will continue to serve as president and the present staff of employees is to be retained.

●

McAvity Appointments. — G. Clifford McAvity, president and managing director of T. McAvity & Sons, Limited, has announced the appointment of George McAvity to the office of Vice-President in charge of manufacturing. He also announced the appointment of James L. McAvity to the board of directors.

In his new duties Mr. George McAvity will supervise the manufacturing activities of the Company with which he has been associated for the past sixteen years. He is the member of the fourth generation of his family to be active in the management of T. McAvity & Sons Limited.

James L. McAvity is Maritime sales manager for the Company. He is a director of the Canadian Institute of Plumbing and Heating, The Canadian Exporters' Association and the Canadian Waterworks Association.

Other officers of the Company are W. A. S. Case, executive vice-president and secretary-treasurer; J. S. Hoyt, vice-president in charge of sales.

●

International Nickel Appointments. — The International Nickel Company of Canada Limited has announced the following appointments. Dr. Paul D. Merica, formerly executive vice-president and a director, has succeeded Dr. John F. Thompson in the presidency. The announcement of this appointment was made by Dr. John F. Thompson, chairman of the Board and retiring president. Dr. Thompson was elected chairman of the board of directors in February, 1951, on the death of Robert C. Stanley.

R. Leslie Beattie, vice-president and general manager of the Company's Canadian operations, has moved his headquarters from Copper Cliff to Toronto and has been elected a member of the executive committee of the board and a director of the Company's United States subsidiary. H. C. F. Mockridge, Q.C., of Toronto, was also elected to the executive committee of the board.

J. R. Gordon, assistant vice-president, has been appointed to the further post of assistant general manager. In these capacities he will manage all activities in the Canadian operations under the direction of Mr. Beattie.

Ralph D. Parker, assistant vice-pre-

(*Continued on page 707*)

George McAvity

James L. McAvity

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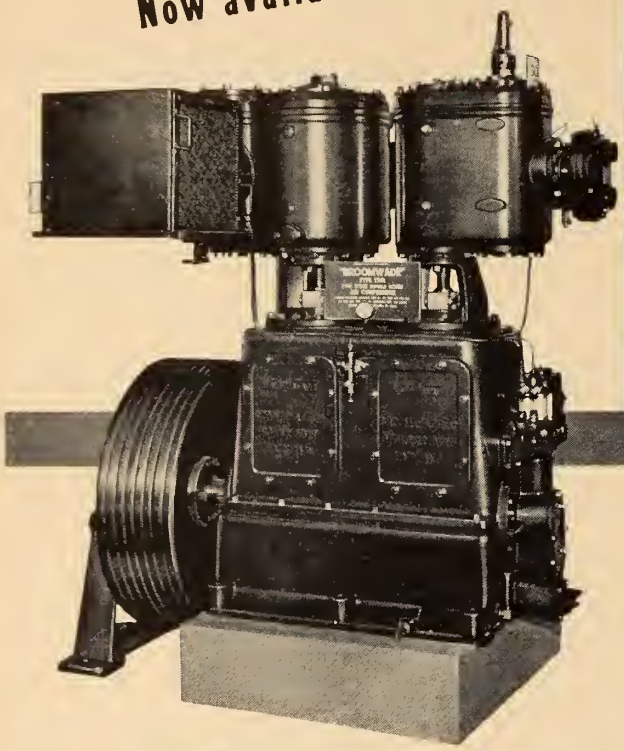

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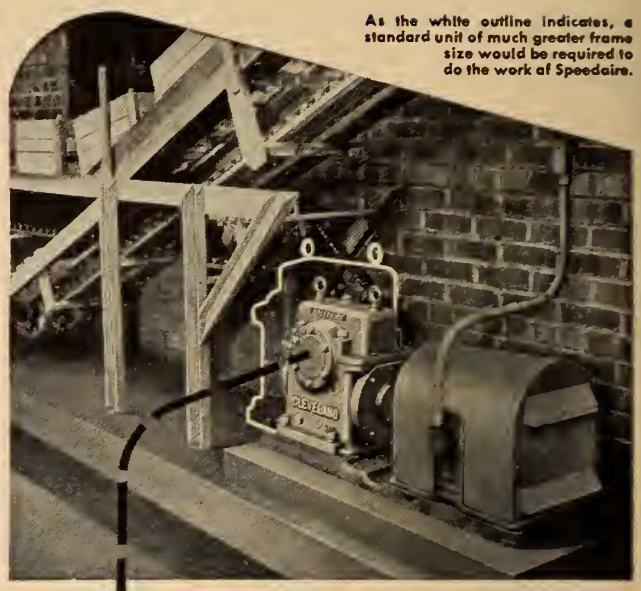
VANCOUVER: B.C. Equipment Co. Ltd., 551 Howe St.



As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

Photo by courtesy of Telling Belle Vernon Division of National Dairy Products Corp.

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OPERATING outdoors, with no protection from rain and snow, this Speedaire unit has run steadily for 54 months without any maintenance whatever. It replaced another type of drive on which upkeep was very high and down time excessive. It also saved the company 15.9% of the cost of a conventional worm gear drive. It is one of 7 Speedaire units driving conveyors at a dairy products plant.

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Representatives in Canada of The Cleveland Worm & Gear Co. and The Farval Corporaion.

CLEVELAND
Worm Gear
Speed Reducers

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 703*)

sident, has been elected vice-president and a director of the Company's subsidiary, Canadian Nickel Company Limited.

William F. Kennedy has been named secretary of the company. He succeeds Henry S. Wingate, who will devote his full time to duties as vice-president and a director of the Company.

●

Canadian Line Materials.—Thomas G. Quance has been named assistant to L. E. Messinger, president of Canadian Line Materials. He succeeds D. R. E. Barnaby who has moved to the United States as plant manager of Line Materials Kyle Plant.

●

Barber-Greene in Canada. — Barber-Greene Company, manufacturers of conveyors, ditchers, loaders and asphalt paving equipment, announced the formation of a Canadian manufacturing subsidiary, Barber-Greene Canada Ltd. The new organization will be a wholly owned subsidiary of the parent Company which has headquarters at Aurora, Illinois, U.S.A. The American concern also operates a British manufacturing subsidiary, Barber-Greene-Olding Ltd. of Hatfield, Herts.

President of the new Canadian subsidiary will be Walter B. Holder who was formerly general sales manager of Barber-Greene Company. A site of approximately 15 acres has been purchased in North York Township, a suburb of Toronto. Construction of a combination office and factory has commenced and completion is expected by January, 1953.

At the outset, fabrication and assembly in the Canadian plant will centre on the Barber-Greene conveyor line with expansion into additional models and equipment contemplated at a later date.

Sales management of Barber-Greene's Canadian distributors has, heretofore, been vested in the Aurora headquarters of the Company. This supervision will now be undertaken by the Canadian company. All distributors will handle the complete Barber-Greene line. The Canadian distributors are: Frost Machinery Co., Vancouver, International Agencies and Machinery Co. Ltd., Vancouver; Mussens, Canada, Ltd., Montreal and Fredericton; Ontario Equipment Co., Ltd., Toronto; Wilkinson and McClean Ltd., Edmonton and Calgary.

Until occupancy of the new building can be effected Barber-Greene Canada Ltd. will be located in temporary quarters in Room 501, 350 Bay Street, Toronto.

●

Defence Production Changes. — The following changes have been made in the personnel of the Department of Defence Production. Dr. H. H. Saunderson has been appointed to the position of co-ordinator of materials. H. J. Sissons, who has been co-ordinator since September, 1951, is returning to the Ontario Hydro to resume his duties as executive assistant to the general manager. T. N. Beaupre has been named assistant deputy minister. J. C. Rutledge has been appointed deputy co-ordinator of the general purchasing branch. Mr. Rutledge was formerly secretary of the department and he has been succeeded in that division by G. P. O'Keefe. F. L. Trethewey is resigning from his position as aircraft contracts administrator. Stanley Marsland has succeeded Edgar Barker as head of the machine tool division. The new director will make his headquarters in Ottawa.

●

J. E. Gilbert.—The Honourable C. D French, Minister of Mines for the Province of Quebec, has announced the appointment of Dr. J. E. Gilbert to the post of resident geologist for the Rouyn-Noranda mining district of western Quebec. The principal duties of the new resident geologist will be to carry on with the gathering, co-ordination, and compilation of all geological information in his district with a view to assisting in the developing of its mineral resources.

●

R. C. Bell.—R. C. Bell has been appointed a senior research engineer by the Consolidated Mining and Smelting Company of Canada Limited.

●

Ira E. Puddington.—Dr. Ira E. Puddington has been appointed director of the division of applied chemistry at the National Research Laboratories. He succeeds the late Dr. Adrien Cambron.

Dr. Puddington will continue his work as head of the colloids section.

●

Leo Marion.—Dr. Leo Marion has been appointed director—jointly with Dr. E. W. R. Steacie—of the division of pure chemistry at the National Research Laboratories. Dr. Marion was formerly assistant director of pure chemistry and will continue his work as head of the organic chemistry section, a field in which he has an international reputation.

●

Paul Leman.—Paul Leman has been named a vice-president of the Aluminum Company of Canada Limited. He joined the Company in 1937 after being admitted to the Quebec Bar. From 1942 to 1945 he was assistant secretary of the Company. He was appointed secretary of the Saguenay Power Company Ltd., in 1945. In 1949 he was appointed treasurer of Aluminum Company of Canada Limited and will continue to serve in that capacity.

●

H. George De Young. — Atlas Steels Limited, Welland, Ontario, has appointed H. George De Young, vice-president of operations. The announcement was made by R. H. Davis, president of the Company. Mr. De Young has been works manager since January, 1951.

●

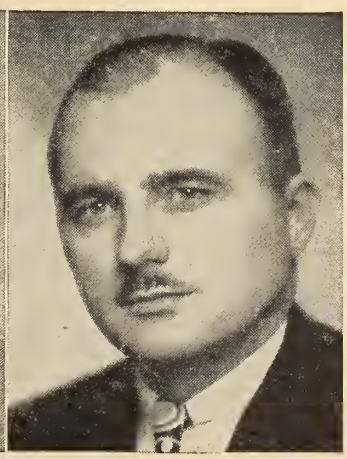
Dominion Wheel & Foundries Appointments.—Dominion Wheel & Foundries Limited, after the recent annual meeting of the Company, announced the following appointments: Edgar E. Ritcey, president; Charles H. Ley, vice-president; David H. Gilbert, Winnipeg, vice-president; Benton Dixon, director and sales manager. The Company manufactures chilled car wheels for every purpose and provides general foundry and engineering services at Toronto and Cobourg, Ontario; New Glasgow, N.S.; and St. Boniface, Manitoba.

Dominion Wheel and Foundries Appointments

Edgar E. Ritcey

Charles H. Ley

David H. Gilbert



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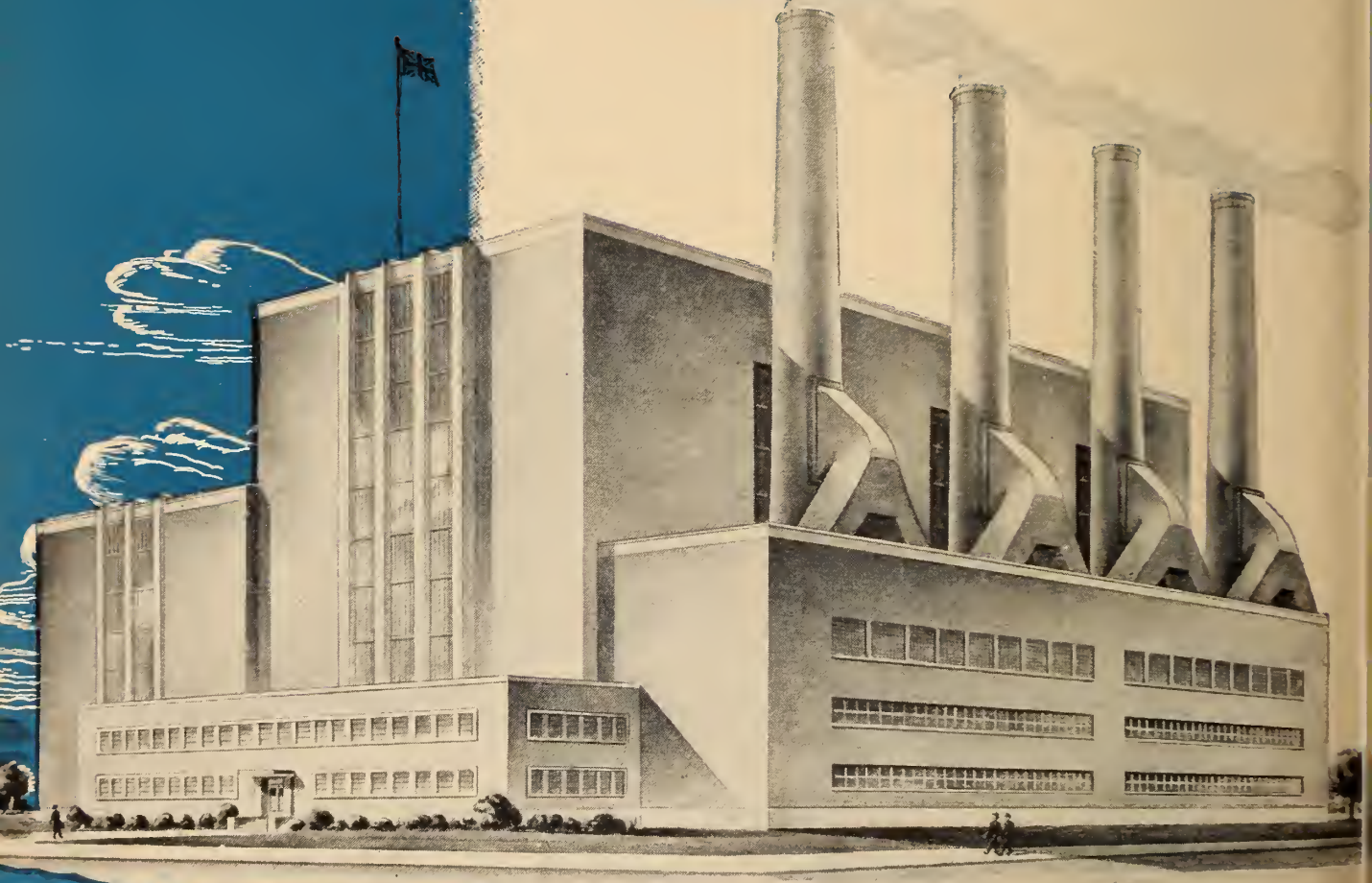

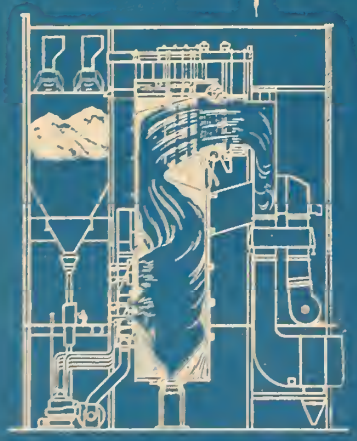

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* * *

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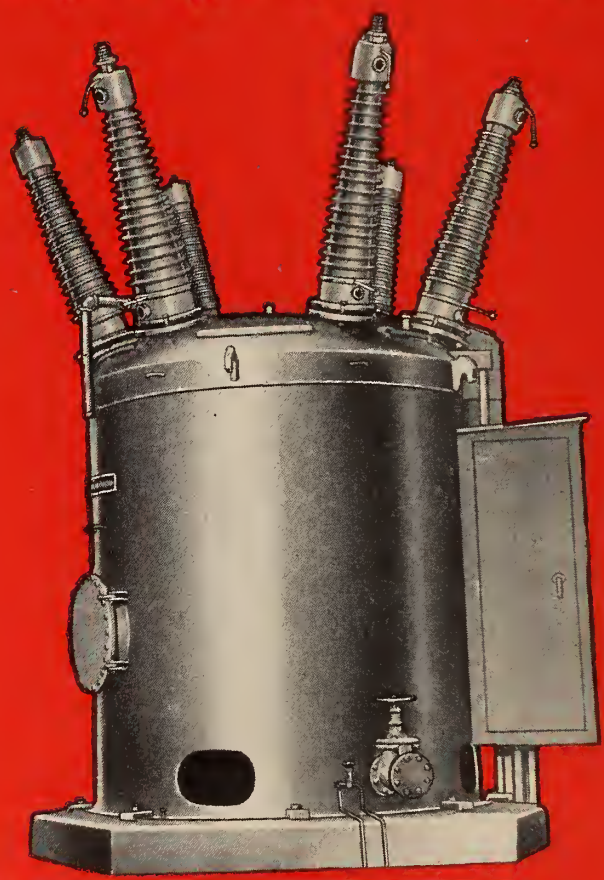

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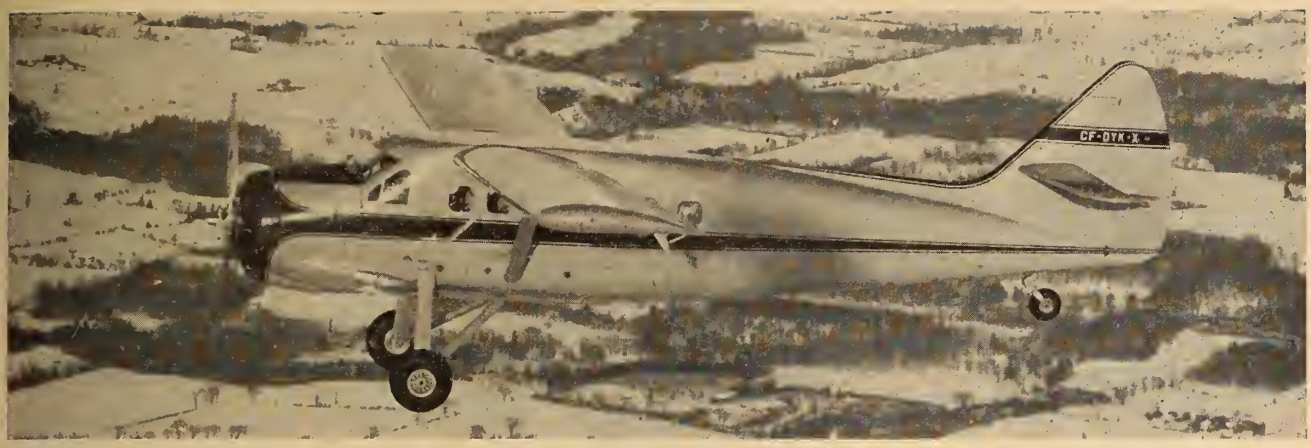


Fig. 1. Otter in flight.

Design of the de Havilland "Otter"

A paper presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, B.C., May 7, 8 and 9, 1952.

by

R. D. Hiscocks, M.E.I.C., and F. H. Buller

de Havilland Aircraft Corporation, Toronto

Popularity of the de Havilland "Beaver" since its introduction in 1947, led to the development of a larger aircraft of the same type. The "Otter" is a single engine aircraft with 1,000 mile radius, capable of carrying 14 passengers or six stretcher cases. Typical uses would include forestry patrol, rescue work, crop dusting, military supply dropping and liaison duties. Design features are described in this paper.

A market survey which preceded the design of the de Havilland Beaver in 1947 revealed that certain characteristics are of paramount importance in a bush aeroplane. These are an excellent take-off performance and a low landing speed, good handling qualities at all speeds, ease of maintenance under primitive operating conditions and a ready conversion from wheels to floats or skis.

Experience with the Beaver has indicated that the original specification was sound, and that the emphasis on take-off and landing performance has permitted economical flying in places where none was practicable before. It has also been encouraging to find that such conditions are not confined to Canada, and that a healthy export market exists for a versatile aeroplane of this type.

It was further concluded that a requirement existed for a larger aeroplane having the same characteristics, but with approximately twice the useful load. Design work was initiated some fifteen months ago and this new aeroplane, the Otter (Figs. 1 and 2), flew almost exactly one year later. The Otter is designed specifically for operations in undeveloped areas with only the most limited facilities. Typical duties would include forestry patrols, aerial ambulance and rescue work, crop dusting and aerial spraying, military supply dropping and liaison duties, and general charter operations.

In the design of this aeroplane every effort has been made to live up to the famous dictum of Stout: "Simplicate and add more lightness." A fixed undercarriage is necessary on floats; on wheels the drag penalty is accepted in preference to a heavier structure and hydraulic system. A high strut braced wing arrangement permits good vision from all windows, a large cabin unencumbered by wing structure, and facilitates the loading of the aeroplane as a seaplane. The cabin will seat a maximum of fourteen occupants, or accommodate six stretcher cases with attendants. Sufficient fuel is carried in tanks under the cabin floor to provide a range of 1,000 miles.

In the interests of simplicity and economy a single engine is preferred. As a result it is essential, even at some weight penalty, to use a

conservatively rated engine of proven reliability. As an engine proportionately more powerful than that of the Beaver was not available, it was necessary to carry aerodynamic and structural refinements somewhat further in order to assure a comparable performance. This was not considered to be a serious drawback, because if the difficulties could be overcome, it would result in a more efficient aeroplane. In what follows an attempt is made to outline some of the methods employed to solve the various problems.

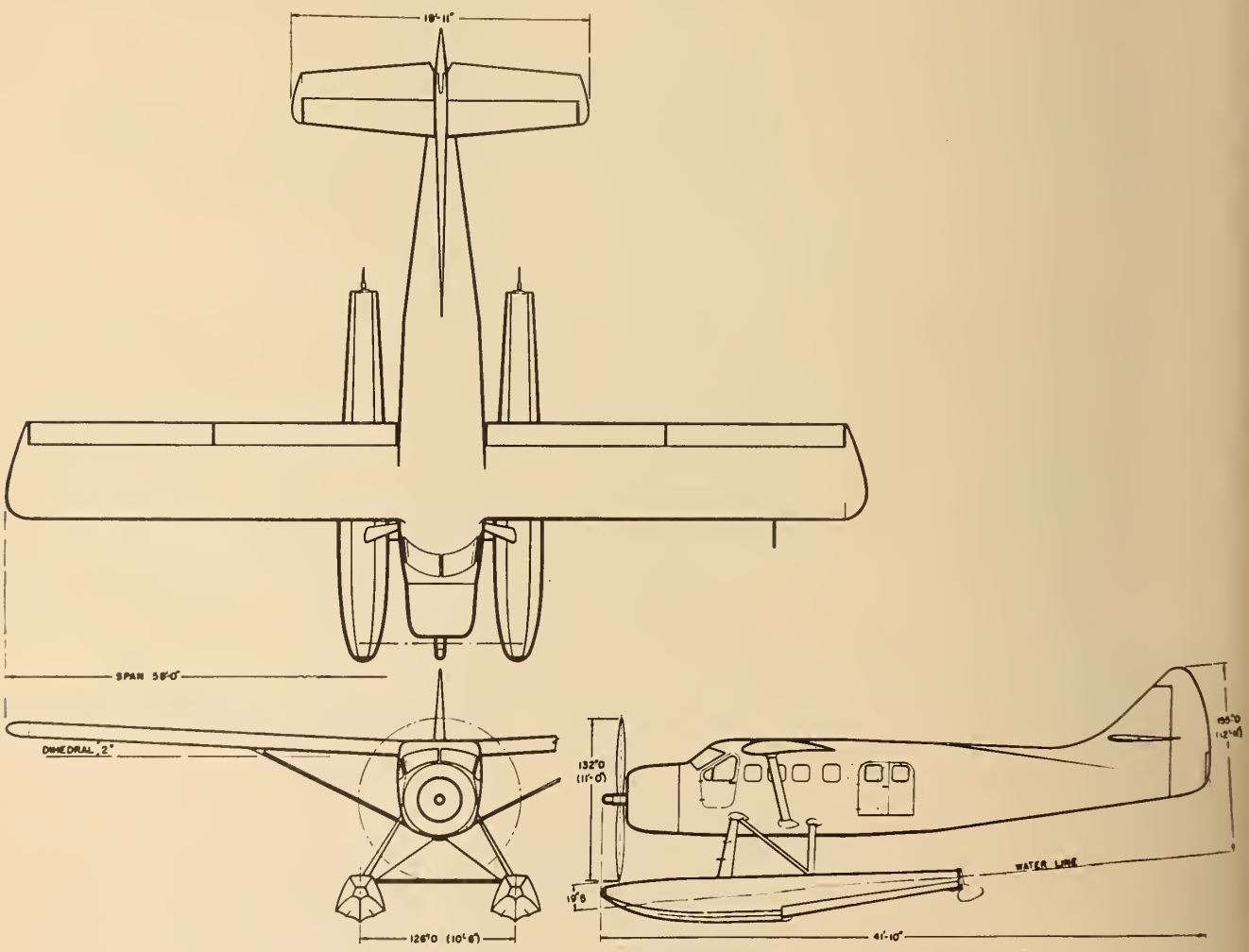
Wings and Flaps

Considering some aerodynamic features first, it is obvious from the general requirements that a careful wing design was necessary, with the minimum wing loading and span loading consistent with a reasonable weight and good handling qualities. In the design of the wing profile an attempt was made to use recent theory to arrive at a section which would have moderate drag by current standards, have docile stalling characteristics and remain insensitive to manufacturing irregularities, the bodies of insects and small ice accretions. It is not entirely surprising, perhaps, that the section selected after a rather involved study bears a strong resemblance to that adopted a long time ago in Nature for the soaring birds.

On aeroplanes with a moderate wing loading it is sometimes questioned whether the complications necessary to produce effective flaps are worth while. They may be justified on safety grounds alone; the majority of aircraft accidents occur in take-offs and landings, and statistics show that the prospects of survival are considerably enhanced if the speed is under 60 m.p.h. when a mishap occurs.

As the ability to operate from small lakes and fields is of paramount importance, much consideration was given to the merits of various flap designs. The main flaps extend over the entire span and are divided into inboard and outboard sections of approximately the same length. The main flaps carry supports for the movable trailing portions, which function as supplementary flaps inboard and inset ailerons outboard. For a 40° setting of the inboard main flap, the linked trailing portion is deflected an additional 20°, whilst the interconnected outboard main flap is deflected 30°.

With this somewhat formidable array of flaps, decisions concerning optimum slot shapes and hinge axis locations were not to be taken lightly. The project profited considerably from large-scale wind tunnel tests conducted by the National Aeronautical Establishment. As a result of these tests, and on the advice of staff members of the Establishment, minor changes were made in geometry with quite



DHC 3 ---- SEAPLANE

Fig. 2. 3-view of Otter on floats.

considerable gains in maximum lift and in the rolling power of the ailerons. Some results are shown in Fig. 3.

Drag

A high lift coefficient will materially reduce the take-off run with a wheel undercarriage on soft ground or with floats, because the aeroplane is not required to accelerate to a high speed to unstick. In Fig. 4 both drag and thrust are shown for the Otter seaplane during take-off. The total drag is not reduced by an increment in wing lift, because the reduction in float drag is offset by increased aerodynamic induced drag. The reduction in take-off run therefore results from the low speed at which the aeroplane becomes airborne. The importance of the propeller thrust is clearly demonstrated. The margin between thrust and drag is a measure of the force available to accelerate the aeroplane, and the superiority of a large diameter, geared propeller over the direct drive version is apparent.

An "envelope" polar curve derived from wind tunnel test results is shown in Fig. 5 for the wing section with various flap settings. It is evident that the section lift is carried to a high value before the drag begins to rise rapidly. It can readily be shown that the sinking speed of an aeroplane in power-off glide is proportionate to $C_D/C_L^{3/2}$ for a given wing loading and gross weight. This also represents the power required for level flight. Hence a low value of $C_D/C_L^{3/2}$ means that the aeroplane can cruise with a small amount of power, and the difference between this value and the maximum engine-propeller output is available for climbing. A large power margin means a high rate of climb. The angle of climb, however, is dependent on the power margin available at a low forward speed.

Performance

The role of the flaps in this connection is shown in Fig. 6. The best angle of climb ϕ results when the main flap setting is 30° and the forward speed is little above 70 m.p.h. To the bush operator a large angle at a low forward speed is far more important than rate of climb. It is a common observation that the smallest lakes are surrounded by the tallest trees!

Small field operations require a landing performance which will match the take-off ability of the aeroplane. It must be possible to lose height rapidly at a low forward speed, and the angle of glide must at all times be under the control of the pilot. The gliding angle of the Otter is shown in Fig. 6. It is evident that the angle of approach θ may be varied within wide limits, depending on the flap setting and forward speed. A steep angle of approach requires highly effective elevators and careful judgment on the part of the pilot, in order to accomplish a brisk round-out immediately before touchdown.

March weather in Ontario is not ideal for accurate take-off and landing trials, but some preliminary measurements have been made with a traversing camera, and the results are shown in Fig. 7. These show that the take-off distance to clear 50 ft. is approximately the same as the landing distance over a 50 ft. obstacle.

In certain types of work, such as crop dusting, an aeroplane may be required to perform lively manoeuvres near the ground, and good low-speed handling qualities are essential. This introduces problems, because slipstream effects are most marked at low speeds. The response to both elevators and rudder becomes somewhat lethargic when the latter are operating in the highly disturbed wake behind full span flaps. Horn balances, as adopted for the Otter, present advantages which include reduced hinge moments and an improved stick-free stability. It requires careful proportioning and flight-testing to ensure that refractory characteristics do not appear in rough air, however.

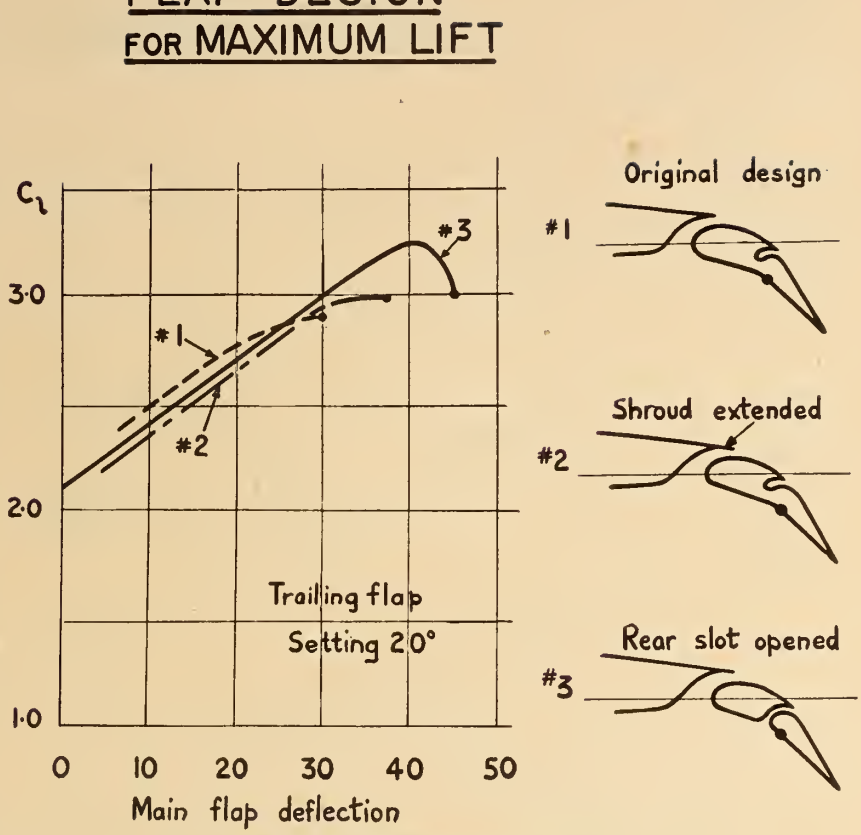
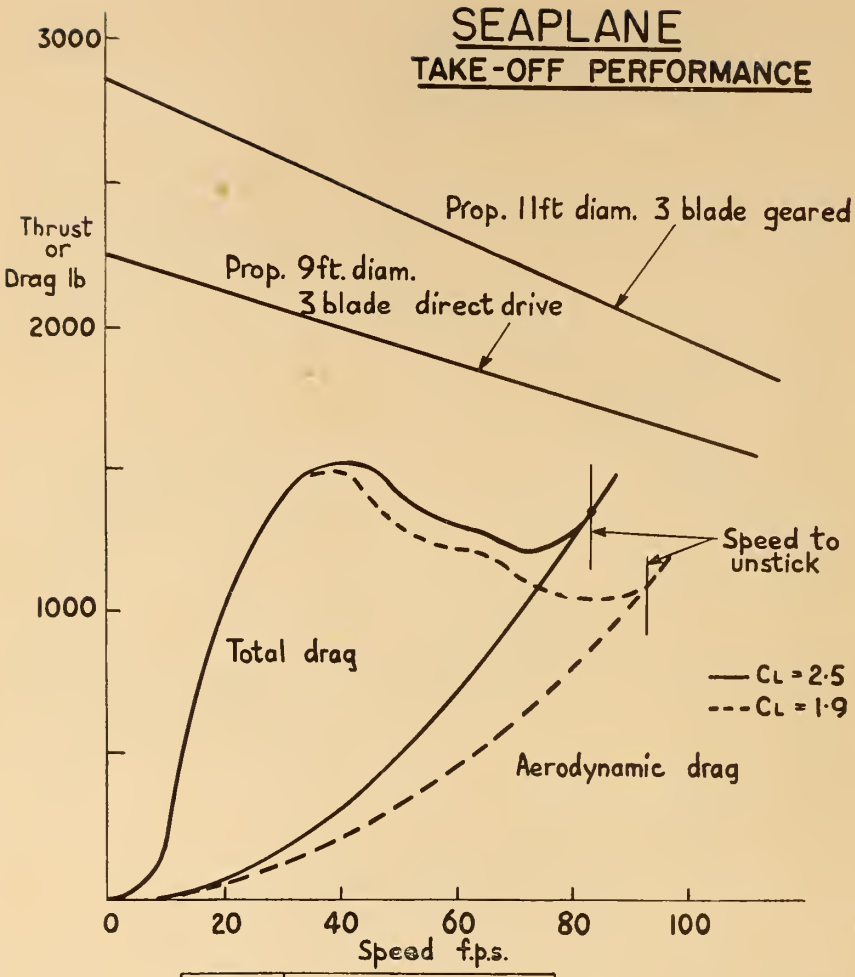


Fig. 3. Flap design for maximum lift.

Stabilizer

A wide centre of gravity range combined with powerful flaps produces rather exacting requirements in longitudinal trim and control. With this aeroplane an adjustable stabilizer was adopted in preference to elevator trim tabs. An inverted airfoil section was selected for the horizontal tail, in order to reduce any possibility of tail surface stalling with full flap and maximum forward centre of gravity.

A good rolling performance at low speeds also presents problems, because the requirements of high lift and high rate of roll conflict. Powerful flaps must extend over most of the span, effective aileron must also have a large span. The compromise adopted with the Beaver was to "droop" the aileron with the inboard flaps, restricting the droop to a value which would



Prop. diam. ft	Estimated dist. to unstick ft.	
	$C_L = 1{\cdot}9$	$C_L = 2{\cdot}5$
11	1050	750
9	1300	1000

Fig. 4. Seaplane takeoff.

provide a modest lift increment without prejudice to lateral control. A higher lift increment was desired of the Otter, hence the more sophisticated arrangement.

Ailerons

Further conflict between the requirements of lift and roll arises from the adverse yaw produced by conventional ailerons. The rolling velocity is reduced by adverse yaw, and the latter is directly proportional to the lift coefficient. At the low landing speed of the Otter it was estimated that adverse yaw would reduce the rolling velocity produced by conventional ailerons as much as 40 per cent. Spoiler type ailerons were therefore considered, because in theory they could be arranged to provide not only a rolling moment but also a drag moment, in the sense required to counteract adverse yaw and at the same time leave the wing trailing edge free for full span flaps.

For test purposes the conventional ailerons on a Beaver were replaced with spoilers. The results were noteworthy only for the consistency with which the spoilers produced neither drag nor rolling moments. Conventional ailerons were accordingly decided upon. To ensure that they would be adequate, two minimum requirements were established, a helix angle $\left(\frac{pb}{2V}\right)$ of 0.07 after a 40 per cent reduction for adverse yaw, and a minimum wing tip tangential velocity (pb) of 15 f.p.s., at the approach speed for landing. Early tests with an aileron having a sealed hinge were discouraging, but the introduction of a gap at the leading edge (Fig. 8) improved the results considerably, and the required performance was met, even with large deflections of the main flaps. Otter aileron effectiveness factors, computed from wind tunnel tests, are given in Fig. 8.

Cooling System

Cooling difficulties are not uncommon in this type of aeroplane, because the maximum engine output is often required in a steep climb at a low forward speed. Adequate cooling requires a substantial weight of air to be pumped through the cylinder baffles, and at a forward speed of 60 m.p.h. there is insufficient dynamic pressure to do this pumping. Adjustable gills may be used to produce low pressures in the region of the cooling air exit, but a considerable drag penalty results, and there is the complication of an additional control for the pilot.

It appeared attractive therefore to employ an ejector system for the cooling, using the momentum of the engine exhaust gases, which is normally wasted, to pump cooling air. This system has the advantage of providing maximum cooling in full power conditions, with forward speed a secondary factor. The general arrangement is indicated in Fig. 9. There is considerable design information of a general nature on ejector systems, but the combination of the radial engine and relatively bluff fuselage presented some special problems. It was felt that the installation would benefit from "ad hoc" testing. The ground running test rig was accordingly equipped with instruments, and residents in the vicinity of the de Havilland Airport shared with the Engineering Department some of the trials of the development program. As a result of this work, the Otter displays satisfactory cooling characteristics under all flight conditions. In addition, it enjoys in cruising flight a measurable amount of thrust from the ejector tubes, rather than the drag losses usually associated with cooling requirements.

Fuselage

In an aircraft of the Otter type, with a fairly low wing loading, generous control surfaces and a relatively bulky fuselage, the Structural Loading Coefficient is very low indeed. This naturally means that the usable stresses in most parts are limited by elastic or plastic instability. As a consequence, a good deal of experimental work had to be undertaken in the early stages of the design to determine usable stresses, and to settle on the most efficient forms of stiffening.

In general, it is Company practice to treat simple or determinate structures and mechanisms by straight analysis, with supplementary tests of course to cover castings and unusual parts. For very indeterminate or diffuse structures, however, reliance is placed principally on tests of complete units. Analysis is used in a simplified form as a guide in design proportion — coupled with engineering judgment. However, a conscious attempt is made to design light, particularly with regard to stiffeners and skin gauges, and to patch and modify on test where necessary. The degree to which parts are designed light depends on a number of things — the probability of catastrophic failure on test, and the accessibility of the part for examination and repair during test.

The amount of reinforcing required with this philosophy usually turns out to be surprisingly small. In the case of the Otter fuselage, which was thought to be designed very light, the total weight added during tests was only about 15 lb. or about 2 per cent of the original weight. The additions to tail surfaces and wings were almost negligible. The construction of the fuselage is fairly conventional, although a great deal of effort was spent in keeping the weight as low as possible. The most noteworthy feature from a structural point of view is the number and size of the cut-outs.

The main cargo opening seemed a forbidding problem at first. As it was difficult of accurate analysis it was designed much lighter than analysis would dictate, in the expectation that a great deal would be learned about this type of problem as successive reinforcements were added during testing. As it turned out, the only addition required was the increase in gauge of two stiffening members. The weight increase was about 3 ounces. The total weight penalty of the door cut-out is far below most published data. This is probably because the structural density of the parent structure is so low that a modest amount of added stiffening greatly increases the permissible stress in the surrounding material.

Corrugated Skin

The Otter wing design is in many respects unusual, due to the uniquely high ratio of torsion to bending loads. The torsion is high because of the lack of taper and very powerful flaps; while the bending is low because the single strut relieves bending but not torsion. It was obviously necessary to distribute a large portion of the material in the skin, where it could contribute to torsional strength. At the same time such a distribution poses a formidable problem in the diffusion of the strut load into the widely distributed structure. A study of the skin shear problem indicated that the usual skin-stringer combination for the upper surface would result in a prohibitive weight.

A corrugated inner skin supporting the upper skin was therefore settled on, because of its ability to share the shear flow under the torsion (flaps down) case, as well as its good compressive load carrying ability. This corrugated construction is not new, but it has probably not been used before in a wing of such low structural density nor, it is believed, has it been used before primarily to assist in carrying shear loads. The type of corrugation used is the omega shape, because of the greater local stability as

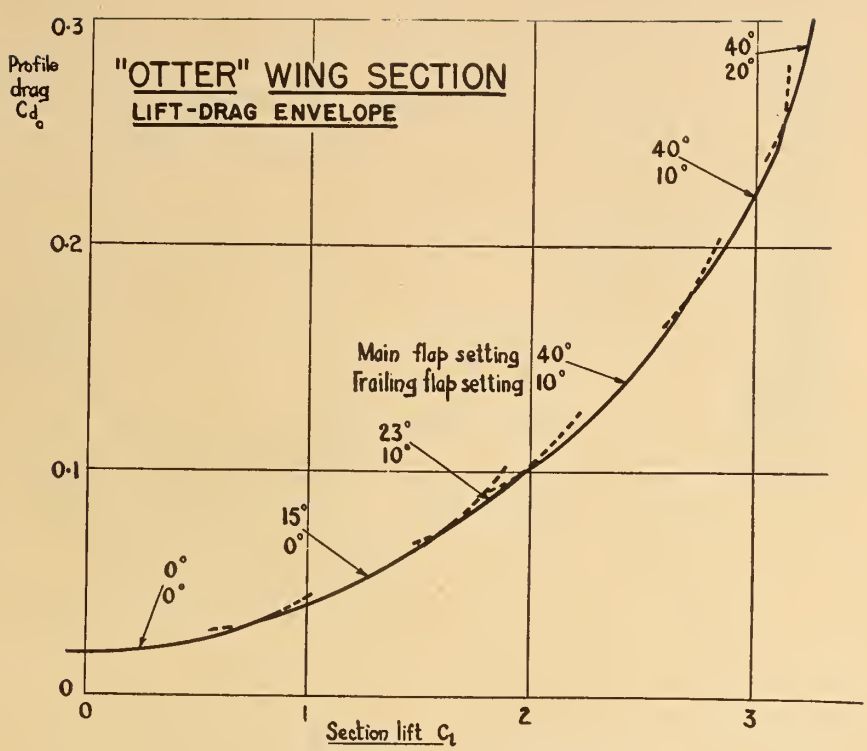


Fig. 5. Wing section lift-drag envelope.

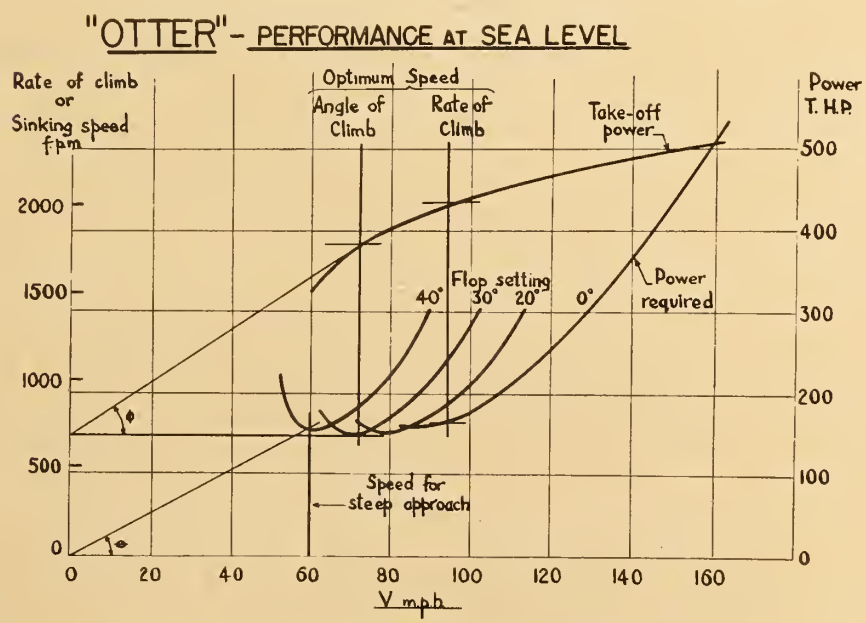


Fig. 6. Performance at sea-level.

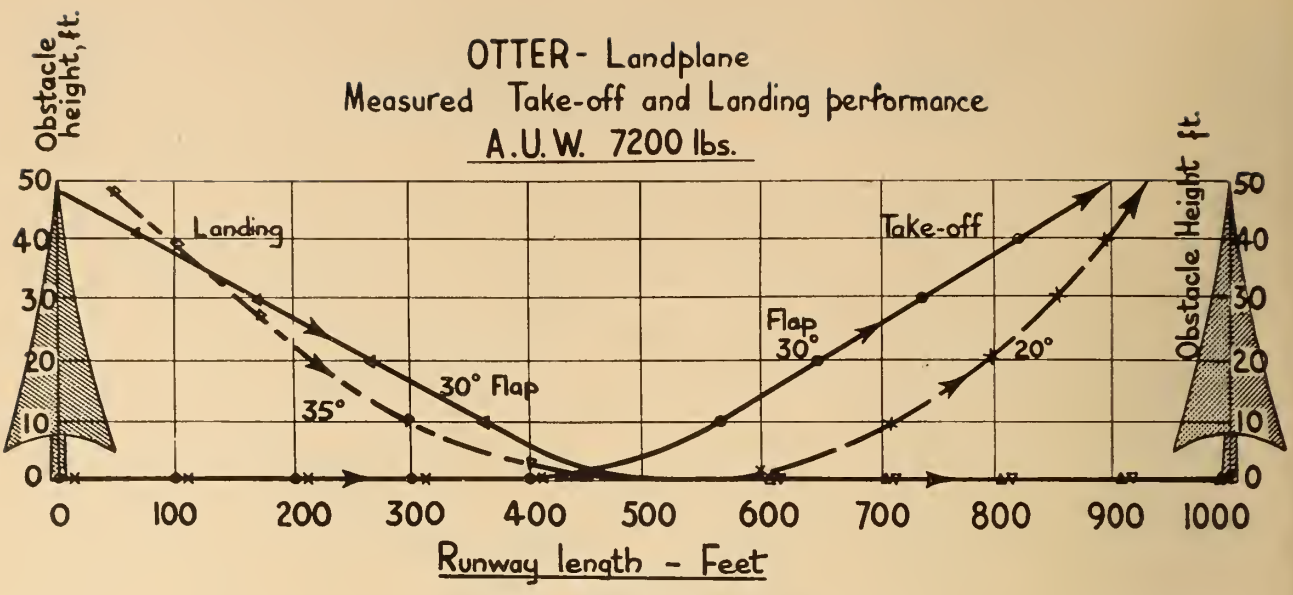


Fig. 7. Takeoff and landing—measured.

compared with the circular arc type. To further raise the permissible stresses and to reduce accidental damage in handling, these parts are given an artificial aging treatment after forming, the material ending up as 24ST81+.*

Struts

An examination of the loads in the lower surface shows an abrupt discontinuity at the point of the strut attachment, — a drop in spanwise tension load from 80,000 lb. to 44,000 lb. In order to put the maximum material in the skin and stringers they were made sufficient to carry the entire load inboard of this point. All the extra material outboard was applied to the spar lower flange in a member tapering off outboard as the cantilever load diminishes, soon disappearing altogether at the point where the skin and stringers are capable of handling the cantilever tension. In this way, the stresses in the spar flange and the adjacent stringers remain constant over a considerable span, including the portion past the fitting. As this represents equal elongations in the adjacent members, no shear flow takes place between them.

After the wing design was completed, a detailed analysis was made by the 'relaxation method', and the original assumptions were confirmed. On test, no evidence could be seen of local distress in the region of the strut fitting.

The thought of chopping off the spar tension flange abruptly at the point of highest bending moment is at first most repulsive to a designer. Thus it is small wonder so simple a solution was not arrived at without much thought and discussion.

The wing strut is a detail worth noting. Previous designs had been made of aluminum alloy tubing of streamline cross-section. The limitations of tubing manufacture dictate a constant wall thickness, with consequent sacrifice in structural effectiveness. In the Otter, this unit was made from sheet metal, and the overlaps so disposed to improve moment of inertia about the major axis. By this means, and by careful detailing of the end fittings, this unit turned out slightly lighter than its counterpart on the Beaver, although the length is 20 per cent and load 55 per cent greater. The additional fabrication cost is more than balanced by the lower raw material cost.

The tail control surfaces are made with a corrugated metal skin, .016 thick, without ribs except at their ends. This proved to be the lightest and cheapest construction investigated for units of this low density. Compared to fabric covered units, they are approximately equal in weight, 50 per cent of the initial cost with much lower maintenance, and have far higher torsional stiffness. The flaps are also pure monocoque construction, with ribs only at the pickup or hinge points.

Airframe

The airframe, apart from fittings, is made almost entirely of 24ST Alclad sheet stock and 24ST extrusions. 75ST alloy, now so generally in use, appears in only one part—the upper flange angle of the main wing spar. As most of the sections are so thin that the higher strength properties of this alloy cannot be realized, its shortcomings are avoided by avoiding its use.

Light alloy forgings, also in increasing favour in most quarters, have been almost totally eliminated in this design because of the rapidly increasing die costs and deteriorating supply situation. Frequent use is made, however, of both aluminum and magnesium alloy castings. In many instances, the difference in weight between a casting and forging is much less than the difference in the physical properties might indicate, for the following reasons:

1. Often many portions of the fitting are dictated by practical considerations and not by the applied loads.
2. In many applications and particularly in control systems, the sections are dictated by stiffness rather than strength.
3. It is frequently possible to dispose the metal more advantageously in a casting, due to the greater versatility of the process.

Further to avoid the use of forgings, many fittings have been designed as short lengths of specially shaped extruded bar. Where suitable, this has proved to be far

* Due to the cold work of stretcher straightening at the mill, plus the cold work in forming before artificial aging, the metal is something between 24ST81 and 24ST86. Test coupons show a .2 percent yield of 56,000 to 60,000 p.s.i., as against an original of about 40,000 p.s.i. for 24ST.

cheaper than alternative processes, and in each instance has been competitive from a weight standpoint. The die cost is usually about 1/10 of a forging die. Any subsequent machining operations are simplified by the absence of draft angles. Structural tests were conducted on all components where analysis might not be reliable or might be too pessimistic. The work involved in the design and building of test set-ups to simulate the actual loads is considerable.

Hydraulic loading is used almost exclusively, because of its adaptability and safety. In most cases, electrical resistance type strain gauges are used at numerous points on the specimen, and the strains are read and plotted as the test proceeds. These readings serve a dual purpose; first, they form a check on the analytical assumptions. This provides a more accurate basis for later structural analysis which is often undertaken for record purposes or as a guide in subsequent modifications or repair work. Second, the plotting of strain differences in the form of a "Modified Southwell plot" as the test proceeds is used to forecast failure before it occurs. This reduces the risk of ruining an expensive specimen, and permits the assessment of which loading condition of several tested is the most critical and therefore the case to be loaded to final failure.

In keeping with the design concept, all items of equipment, auxiliary power and mechanical parts were critically examined, to assess whether or not they would really "pay their way" before being included. Any item of equipment which was deemed desirable was chosen or designed with an emphasis on light weight, simplicity and ease of servicing.

Table I — Otter Performance

Engine — Wasp S1H1-G

	Landplane	*Seaplane*
V max. (5,000 ft., 600 B.hp.)	170 m.p.h.	155 m.p.h.
V cruise (5,000 ft., 325 B.hp.)	138 m.p.h.	125 m.p.h.
True Stalling Speed	52 m.p.h.	52 m.p.h.
Maximum Rate of Climb	1,150 f.p.m.	1,050 f.p.m.
Ceiling (Service)	22,000 ft.	21,000 ft.
Maximum Range	1,100 miles	1,000 miles
Maximum Endurance	10 hr.	10 hr.
Take-off Distance to clear 50 ft.	950 ft.	1,100 ft.
Landing Distance over 50 ft. obstacle	1,000 ft.	1,100 ft.
Weight Empty	4,165 lb.	4,550 lb.
Useful Load	3,035 lb.	2,650 lb.
Gross Weight	7,200 lb.	7,200 lb.

Undercarriage

The Otter undercarriage geometry differs from the Beaver's, largely because the fuselage shape makes the type used more economical. The springing, however, is by means of rubber blocks in compression, as was used on the Beaver and numerous other de Havilland aircraft. De Havilland are probably the only company using this method of springing on aircraft of appreciable size. It has been found to have numerous advantages, not the least of which is simplicity and lack of maintenance required.

At one time, rubber in compression had the disadvantage of hardening considerably at low temperatures. The progress in rubber technology had reduced this shortcoming somewhat, but it was not until the Otter design was started, however, that a new rubber compound came to hand, having less change in hardness with temperature than any heretofore tried.

As this showed great promise, blocks were moulded from the new compound. A full scale Beaver undercarriage was submitted to dynamic drop tests in the large Cold Chamber of the National Aeronautical Establishment at Ottawa. These tests indicated a slightly better energy absorption at −40 deg. F. than +75 deg. F. As the "spring" deflections measured were somewhat less at low than at high temperatures, the favourable results are probably accounted for by the increased hysteresis at low temperatures.

Controls

The control system is conventional in type, using wire cable for all main runs. In order to achieve stiffness in the control circuits, large travel of the cables has been used, motion multipliers being employed where necessary to provide the travel. This has proved to be a far lighter method of providing stiffness

(*Continued on page 721*)

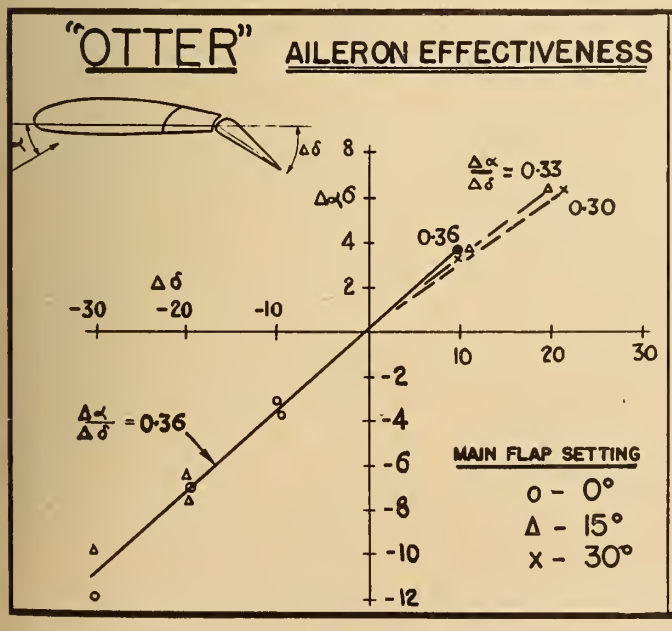


Fig. 8. Aileron effectiveness.

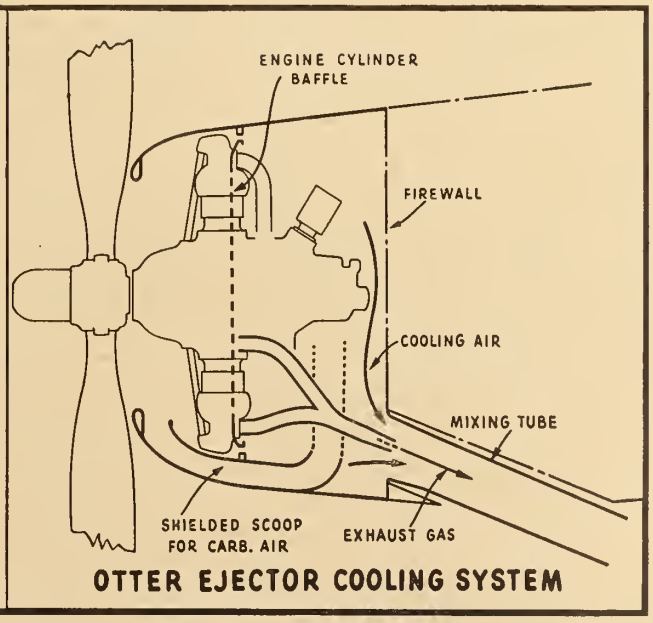


Fig. 9. Engine cooling diagram.

Boundary Waters
between
Canada and the United States

by

General the Honourable A. G. L. McNaughton, C.H., C.B., C.M.G., D.S.O., M.E.I.C.

Chairman

Canadian Section of the International Joint Commission, Ottawa

An abstract of an address presented before the Montreal Branch of The Engineering Institute of Canada, at Montreal, February 14th, 1952.

The subject I have selected is closely related to the functions and specific tasks assigned to the International Joint Commission by the Treaty of 1909, commonly referred to as the Boundary Waters Treaty. This Treaty was entered into by the United States and on behalf of Canada for the purpose of regulating their interests and solving their problems along the 5,655 miles of boundary between them.

These problems are complex, because they involve matters of concern not only within Canada, between the Federal Authority and the particular Province affected, but also because these matters are of concern externally in the conduct by the Federal Authority of our affairs with the United States.

As you will know, the system of organization of government in Canada derives from the principles established by the British North America Act, the foresight and wisdom of which has been proved by long experience. Under our system responsibility for the development and use of our natural resources has been vested in the Provinces. It follows that the most careful consideration must be given to the views of the Provincial authorities concerned.

I propose to mention more specifically those which are of current interest to the people of this part of Canada, in that they relate to the use of the waters of the rivers and lakes along our southern boundary from the Lake of the Woods eastward through the Great Lakes and down the St. Lawrence River to Lake St. Francis, thence on down the national section of the St. Lawrence to the sea.

Recalling that the International Joint Commission approved a St. Lawrence Treaty 30 years ago, the author observes that mutual acceptance of the principle of levying tolls made possible the concept of navigation facilities being built entirely in Canada by a Canadian Seaway Authority. Arrangements are now under way for both governments to make early application for International Joint Commission approval of this alternative, should Congress fail to approve the 1941 Agreement.

The cost to the Federal Government of Canada under such a plan would amount to $250 millions which will be spent for navigation only, throughout International and National Sections, all recoverable from tolls. This compares with a recent estimate for navigation costs under the 1941 Agreement of $220 millions; the difference is principally due to the higher costs of constructing the locks on the Canadian side in the International Section.

Need Urgent but Negotiations Slow

The questions at issue in international boundary waters between Ontario and the adjoining states involve primarily both questions of navigation and of power, and these questions extend their interest also to Quebec in the national section of the St. Lawrence. Flood control, and the use of water for domestic and sanitary purposes continues to present problems, some of which are complex because the vagaries of the currents in the rivers and channels, give rise to a danger that pollution arising in one country will affect the waters of the other country also, thus creating a violation of the Treaty of 1909.

As regards navigation, there are now in existence and continued use extensive systems of canals and locks and dredged channels. These facilities, with the march of time and the growth of our economy, have become outmoded, and are no longer adequate for the service of our expanding industry even in peace. They do not have the capacity to measure up to the requirements which are necessary for defence in these anxious times.

Similarly, as regards power, there have been substantial developments on both the Canadian and United States sides of the St. Lawrence system for the generation of power. Nevertheless, as matters stand, not more than perhaps a third of the power potentially available from the St. Lawrence, including the Canadian Section, is being used. Some of these developments we can make ourselves at our convenience, but in most cases international considerations are involved. There are projects of immense importance which need to be freed from the existing international inhibitions, so that they can be undertaken at the earliest practicable date.

We have learned by long experience, which on occasion has been

painful, that progress with these matters only becomes possible when the views and the wishes of the two peoples have come into full accord, and have found expression in a unified purpose preferably by Parliament and Congress. Whether this takes the technical form of a "Treaty", or of an "Agreement" duly ratified, or merely of an understanding, informal or otherwise, does not matter, because once great works have been created in agreement, we can be quite certain that no one in either country will interfere in their use to the detriment of the other party.

However, where new projects of great magnitude are under arrangement between two countries and particularly where some outmoded facility or vested interest has to be displaced, it is seldom easy, to effect progress. But where the resources to be developed are shared by separate communities in separate countries, then the difficulties presented are almost insuperable if they have to proceed separately through their respective national economic, legal and legislative systems.

Joint Procedure Under Treaty Preferred

The Treaty of 1909 established the International Joint Commission, a body composed of six Commissioners, three on the part of the United States and a like number on the part of Canada. In order to discharge its responsibilities effectively the Commission has been armed with authority which, in certain precisely defined spheres, has been placed above that of the national law.

For example, and unless there has first been a special agreement between the Governments of Canada and the United States "no further or other use or obstructions or diversions, whether temporary or permanent of "boundary waters" on either side of the line . . . shall be made except by the authority of the United States and . . . Canada within their respective jurisdictions and with the *approval* of the International Joint Commission."

By these provisions the power to initiate plans for the deepening of channels, the construction of breakwaters, the improvement of harbours, and the like, is left to the respective Governments on their own sides of the line, provided that the results "do not materially affect the level or flow . . . at the other . . ." in which case the plans must be submitted to the Commission for "approval".

It was pursuant to these provisions that, in January, 1920, the question of the further improvement of the St. Lawrence River between Montreal and Lake Ontario for navigation and power was referred to the Commission for examination and report. To assist in the consideration of the engineering aspects of the matter a Board of Engineers with a representative from each country was set up to report to the Commission.

The Commission and the Engineering Board gave careful study to the matters which had been entrusted to them. After the conduct of a most comprehensive series of public hearings in both countries, the Commission recommended that the Governments of the United States and Canada should enter into a Treaty for a scheme of improvement of the St. Lawrence River between Montreal and Lake Ontario accordingly. This report was rendered in December, 1921, and since then, for 30 years, the matter has been before both Governments in an endeavour to negotiate and obtain approval for the recommended Treaty or Agreement.

Up to 1928 there was little disposition in Canada to proceed, because it was felt that we were perhaps still overburdened financially as a result of World War I. However, from then on the situation changed and ever since, through a series of draft Treaties and other proposals, the project has had the full support of Canada. Forceful statements to this effect have been made repeatedly by the Prime Minister and other Ministers which have made it clear that our country continues to stand ready to go on with the St. Lawrence project for navigation and power on the basis of the Agreement to share the costs negotiated in 1941, which is the latest in the series, whenever the United States will be willing to proceed.

This procedure is preferred, not because Canada might have any difficulty in financing the work, but for the reason that any new Agreement might involve lengthy discussion which it is desired to avoid, because it has now become most urgent that an early start be made on construction.

This need for early action applies not only to the works contemplated on both sides in the International Section of the river for power. The need applies also for early action on the construction of the navigation facilities which recent estimates show will be used, well up to capacity, as soon as they are made available and because their absence has become a serious disadvantage to the trade and commerce of Canada.

All-Canadian Development Proposed

The Minister of Defence Production, C. D. Howe, HON.M.E.I.C., has pointed out that, now that the principle of tolls to cover the operating, maintenance and amortization costs of the navigation facilities has been accepted by both countries, it makes little difference whether the capital costs are shared at the start or written off from revenue later. He has proposed therefore that, subject to arrangements being accepted for an appropriate United States authority and Ontario to handle themselves the developments for power on their respective sides of the boundary, the Government of Canada would agree to construct all the works required for navigation, not only in the national section of the river in Quebec, but also in the International Section. To this end it is proposed that the navigation canal locks placed on the New York side in the earlier plans should now be built on the Ontario side, where it is said they will give a somewhat greater traffic capacity but at some additional cost.

As you will know, an agreement covering the power aspects of this alternative to United States Federal participation in the power part of the combined power and navigation project was signed in Ottawa in December 1951, by representatives of the Federal Government of Canada and the Government of Ontario.

This agreement has since been approved by Parliament, which has also authorized the setting up of a Canadian St. Lawrence Seaway Authority which can handle construction either under the 1941 Agreement so far as Canada is concerned, or alternatively can be instructed to build the navigation features of the whole project should this be the alternative decided upon. In this case the Power Works in the International Section would be built by the Hydro-Electric Commission of Ontario and by a designated United States Authority under plans to be authorized by the International Joint Commission, acting under the provisions of the Treaty of 1909.

Presidential Support

Each President in turn, from President Harding through Presidents Coolidge, Hoover and Roosevelt to President Truman, has endorsed the project and sought the approval of Congress in one form or

another for its execution. This favourable attitude by the Government of the United States continues at this time, when it is again being most strongly urged by the members of Mr. Truman's Cabinet that the project should be pressed by reason of the great urgency of providing improved navigation, particularly for the carrying of iron ore, and also by reason of the urgent need for more power. On 28 January last these views were presented to Congress by the President, in a Statement favouring the combined project for navigation and power as conferring the most far-reaching benefits to the peace-time economy of the two countries. The President made it clear that early completion is a vital matter in relation to the defence of North America.

He has also informed Congress that arrangements have been made for advance preparations to be undertaken for presenting the matter to the International Joint Commission, with request for approval which is the agreed plan should the Congress of the United States decide not to accept the 1941 Agreement.

In addition to the favourable report and recommendations given by the International Joint Commission in 1921, the project for the combined development for navigation and power has been repeatedly before a succession of National Advisory Committees and the like in both countries. In every case the project has been endorsed. It has also received the attention of a series of joint Engineering Boards, where the design of the works required has been developed in great detail, leaving no longer any significant question outstanding between the technical representatives of the two countries.

Canada's Share Under Treaty $220 Millions

Between Montreal and Prescott the presently existing facility for navigation is the system of 14-foot canals built by Canada many years ago to overcome the difference of level between Montreal at 20 feet and Lake Ontario at about 240 feet. These 14-foot canals have a total of 21 locks with ruling dimensions of 240 feet length and 45 feet width as compared with the ruling dimension of 30 feet depth, 800 feet length and 80 feet width which will exist eventually on the Upper Lakes and the somewhat greater minimum depth which is now available from Montreal to the Sea.

This short section of the St. Lawrence River is only passable by small ships of the 2,000–3,000 ton class. It thus presents a barrier to the commerce and trade of the basin which either prevents its development or at least requires the expensive and time-consuming process of trans-shipment once, and sometimes twice, thus creating a burden which has long been felt to be intolerable.

The latest estimates of costs under the 1941 Agreement between the United States and Canada for new works give the total cost as 704 million dollars; Canada's share is given as 220 million, principally to provide the navigation facilities in the Lachine section. The total to be spent by the United States is put at 484 million, which it is said would substantially equalize the costs incurred, or to be incurred, by the two countries in this undertaking of mutual advantage to provide a seaway up the St. Lawrence and into Lake Superior at the head of the Great Lakes.

For these capital expenditures we would obtain the full benefit of 27 feet depth for navigation from Montreal to Lake Ontario, thus eliminating expensive and time-consuming bottlenecks which now hamper traffic, and which would impede the inward movement of iron ore, which will be very important in our defence arrangements. These expenditures also include the funds required to deepen the Welland Ship Canal and the channels from Lake Erie through to Lake Superior to provide for 27 foot navigation.

In addition to thus freeing navigation, the expenditures mentioned would provide for the construction of the dams and the installation of turbines, generators, and power house equipment to develop 1.1 million horsepower on the United States side and a somewhat larger amount on the Canadian side at the Long Sault Rapids on the international section. The unit cost for power to be derived from these installations is low, probably about half of what the equivalent cost would be for steam plants, assuming steam plants of this capacity could be built at this time and kept supplied with fuel.

Channels Under All-Canadian Scheme $250 Millions

In the evidence presented during the last year before Congress and elsewhere, it has been made clear that the United States' half share of the power in the International Section would only represent about the annual increment of load in the area to be served. As regards the Ontario share, we know it could be absorbed quicker than it could be produced, even having regard to the large increment which will be available from Niagara.

As for navigation—recent studies indicate that the savings on traffic will far exceed costs, including those for full amortization of the navigation facilities, with consequent large benefits to be divided between producers and consumers to the great advantage of trade and commerce, after all costs have been recovered in the form of tolls. The total cost for navigation and power to be incurred over a period of six years (or perhaps a year less) does not amount to half as much as some of the larger corporations doing business in steel or in electrical apparatus, for example, are individually accustomed to spend in a single year.

Should Congress *not* approve the 1941 agreement, the costs to be incurred by the Hydro-Electric Power Commission of Ontario together with the "designated Authority" in the United States will amount to about $200 millions each, a total of $400 millions, all of which will be invested as a normal business undertaking by which some 2,200,000 horsepower will be made available to existing markets, half in each country. The cost per horsepower is low, and it is evident that this portion of the project will be self-liquidating and highly profitable.

If Quebec joins with the Federal Government in developing the Section from Beauharnois to Lachine inclusive, this too will represent a remunerative investment for power. There will then only remain the navigation facilities which Canada has been authorized by Parliament to finance and construct. The navigation facilities in the national and international section of the St. Lawrence are estimated at $250,000,000, which costs will be amortized from toll revenue, as already indicated.

Defence Aspects

The total direct "on-site" employment to be given to labour on the project in Canada and the United States is now estimated at about 75,000 man years, or say as an outside figure an average of 15,000 men employed for five years. This total is small indeed when it is compared to the number required to man and support the anti-submarine war organization needed to keep the sea lanes open for the alternative

delivery of iron ore from Africa and South America.

This extra Naval program would probably absorb at least as much steel and other scarce materials as would the St. Lawrence. In addition, it would demand the use of special materials and skills which can ill be spared. We and the United States have already had one costly experience, in the protection of a sea route over which our oil and bauxite had to be transported in World War II, which nearly brought disaster.

The St. Lawrence project for navigation and power, neither in its physical dimensions nor in its financial implications, is the colossal undertaking that some people visualize. But I would agree that superlatives will properly apply to the useful effects on our economy and defence arrangements which will come.

Secretary of State Dean Acheson in the preamble to the Resolution of the Canada-United States Permanent Joint Board of Defence early last year, made reference to the deterioration of the international situation, indicating a period of protracted crisis requiring a steady increase in our military strength. He pointed out that the Seaway Project would yield large additional supplies of power already needed, which would be vital to expansion of our military strength. It would also provide navigation facilities relatively safe from enemy action where most required to move war materials at less cost in money and resources, and would permit greatly increased shipbuilding in relatively well protected areas. The Board referred to Labrador ore as an additional reason for early construction in the interest of defence.

The Board, after searching analysis, stated the project would increase military potential out of all proportion to expenditure in manpower and critical materials, much of which would be required to be used in any event as additional power had to be provided. Having in mind these considerations and re-affirming its previous Recommendations for the construction of the Seaway the Board recommended:

> "That the two Governments take immediate action to implement the 1941 St. Lawrence Agreement as a vital measure for their common defence."

Defence Board and Commission Favour Either Alternative

Thus there is now on the public record the advice of the two bodies which have been created by Canada and the United States jointly to consider matters of mutual interest and concern along our boundary both for Peace and for Joint Defence. The International Joint Commission, and the Canada-United States Permanent Joint Board on Defence, set up by President Roosevelt and Prime Minister King at Ogdensburg in 1940, have both recommended, repeatedly, that the St. Lawrence project for navigation and power should be built, and promptly.

As the matter stands the Resolution of the Permanent Joint Board on Defence is directed to the implementation of the 1941 Agreement. There is no reason to doubt, however, that this Board will be equally in favour of the alternative now being proposed by the Government of Canada. What the Board has pointed out is that the construction of the St. Lawrence Project for Navigation and Power is now necessary; it has not concerned itself in any way with the arrangements by which this desirable dual objective may be fulfilled.

As regards the International Joint Commission, this body made favourable recommendation on the project in 1921, and further action must await an application from the two Governments covering the works on either side needed to be built in the International Section of the River. Applications for this authority are now under advance preparation for submission to the Commission, should Congress decide not to approve the 1941 Agreement.

In these and all other matters before the Commission we seek to dispel any differences which may arise before they may magnify and thus cause trouble on the border. We seek also to recognize the equality of the interests and the rights of Canada and the United States, and to promote the mutual advantage in all matters which come before it for decision. I claim for the Permanent Joint Board on Defence a like attitude of close co-operation and intimate association, in working for the solution of the problems which give us both great concern for our Defence, particularly in these dangerous times. √

DESIGN OF THE De HAVILLAND "OTTER"

(*Continued from page 717*)

than the employment of massive parts. The aileron is controlled by a linkage passing through the hinge point of the flap, in order to keep the motion of the two surfaces independent.

In the interests of light weight, simplicity and ease of maintenance no auxiliary power system is used. Brakes are of the direct operating hydraulic type, using pedal operated master cylinders. By the provision of a toggle action in the master cylinder linkage, and the utmost care in avoiding both mechanical and hydraulic elasticity in the system, it was possible to keep the pedal forces reasonable. This was achieved in spite of the high propeller thrust, while using non-self-energizing brakes. Although the flaps are of large area, the hinge moments are moderate, and it was possible to operate them with a simple hand pump. One hydraulic cylinder located in the fuselage roof operates all flaps by means of a bell-crank and push rod system.

The cockpit layout went through much development in the mock-up stages, and much thought was put into safety aspects. All control knobs are identifiable by colour and by feel, even through a glove, and their motions arranged in a natural sense. The top of the instrument panel is provided with a soft aluminum shield designed to crumple on a crash impact of the pilot's head. The proportions of this unit were determined experimentally by dropping a head on it from heights recommended by recent aviation medical research. Lack of volunteers for this job made it necessary to use a head made of birch.

Economy

Although the emphasis in the Otter design has been in achieving the best performance and structural efficiency, considerations of manufacturing economy have been kept in mind. Some such points have been mentioned under Materials. The use of very thin skins requires a great many rivets. To make this economical, many components have been designed to be made in open panels with as much riveting as possible, done in the open by hand or by automatic riveting machines. This panel construction also reduces the amount of work to be done in the assembly jigs, thus greatly improving their potential output. √

TRANSISTORS

by

D. J. Watson,

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A paper presented before the Electrical Section, Winnipeg Branch, The Engineering Institute of Canada, January 10th, 1952.

The importance of the transistor to electronics can hardly be overestimated. It is more durable, more reliable, and in certain applications a million times more efficient than the vacuum tube. In this paper the author explains what it is, how it works and what it can do.

First to be applied for general use for toll dialling in long distance phone circuits, as production increases its use will spread to electronic computers, aircraft radio and radar, and electronic equipment for guided missiles. Smaller and better transistors are on the way. All fields of electronics will feel the impact. They will bring smaller hearing aids, wristwatch radios, vest pocket public address systems, better radar.

The invention of the transistor is the greatest event in the field of electronics since the vacuum tube. This tiny, pea-sized bundle of metal and plastic will perform many of the functions of the vacuum tube, with considerably better efficiency. In some applications, the improvement in efficiency can be greater than a million-fold. Its expectant life, a measure of reliability, is much greater than that of its predecessor. Considering for the moment these three points, size, efficiency and reliability, to mention but a few of its desirable characteristics, it is apparent that this new electronic tool, however small, has a tremendous future.

During World War II it was found that the silicon diode made by far the best detector for the ultra high frequency, centimetre waves used in radar. The silicon diode is but a streamlined version of the crystal detector used in the early days of radio. It consists of a small wafer of silicon and a cat's whisker of phosphor bronze, enclosed in a porcelain tube with metallic connections at each end. The electrical properties of this diode are closely linked with the chemical and physical properties of the silicon crystal. Naturally, intense interest was focused on the processing of silicon, with the hope that better diodes could be made and the range of our radar sets extended.

At that time, however, the processing of the silicon was far from being on a scientific basis. The metallurgist who could produce good silicon was in a position similar to that of a master brewer or master chef. A pinch of this or that material added to the silicon melt produced the desired effect—but nobody knew why.

Silicon and germanium are members of a group of materials known as semi-conductors. The need for further knowledge of the physics of semi-conductors, such as these, prompted the Bell Telephone laboratories, in New York, to reorganize their physics department in order to form a new group to study this subject. This group, under the leadership of Dr. William Shockley, was confronted with four questions: I. What is a semi-conductor? II. How does its physical nature produce its observed characteristics? III. How does the fabrication and processing of the material affect its physical nature? and IV. Can the flow of current through a semi-conductor be controlled by means external to the circuit, and if so, how?

Their first efforts, in answer to this last question, were directed along the lines of modulating the conductivity of a thin film of semi-conductor, by applying an electric field perpendicular to its surface. The surface charges induced by the application of such a field, would, if they were free to move, affect the conductivity of the film. They found from their experiments, however, that most of the charges were not mobile. This result, together with the results of other experiments, suggested a new theory in terms of surface states.

The new theory suggested new experiments, which, when performed, confirmed this theory and *also* led two members of Dr. Shockley's research group to a concept which, when tested experimentally, resulted in the discovery of transistor action. This event was announced by the Bell Laboratories in June 1948. Since that time, development has proceeded at a rapid pace.

In the two years following, the intense research program, launched by Bell Laboratories, produced improvements to the transistor equivalent to those produced on the vacuum tube by the first twenty years of vacuum tube research. There is now a large staff actively engaged in the development of the transistor and its application at the Bell Laboratories.

What is a Semi-Conductor?

In answer to question I, let us first consider the atom. An atom consists of a positively charged nucleus, around which are distributed one or more electrons. It is by means of these electrons, which are referred to as "Valence Electrons" (Fig. 1-b) that the atom can form bonds with other atoms. In a metal, not all of these electrons are required to form inter-atomic bonds, and there is normally about one free electron per atom. This free

electron is able to move throughout the confines of the metal, and is not associated in any way with any particular atom. A metal, therefore, is a good conductor of electricity, the electric current being carried through the metal by means of the electrons. They are the current carriers. These electrons, however, must distribute themselves evenly throughout the metal. Any change in their numbers per unit volume is accompanied by a change in electric potential.

Now consider the carbon atom. Carbon has a valence of four. With every carbon nucleus, there are four valence electrons. When a carbon atom enters into a crystal lattice with other carbon atoms forming a crystal known as a diamond, each of the valence electrons associates with a valence electron from an adjacent atom. This association of the two electrons forms an "electron pair bond" between the two parent atoms (Fig. 1a). Since these bonds in diamond are very strong, there are normally no free electrons in the crystal lattice. Therefore, diamond is a good insulator. In the diamond structure (Fig. 1c) all the electrons are immobilized by virtue of their positions in the crystal lattice.

An analogy can be drawn to a two storey garage with the lower floor filled. No traffic is possible on the lower floor because there is no space in which the cars may move. There is, likewise, no traffic possible in the upper floor, as there are no cars. The lower floor corresponds to the inter-atomic bonds in the crystal lattice and the upper floor to the state of a free electron, if one existed in the crystal. The cars, of course, correspond to electrons.

Now we have on the one hand the metals which are good conductors and on the other, carbon, in a crystalline form showing good insulating properties. Between these two, conduction-wise, we have a group of materials classed as semi-conductors. Notable among these are the elements silicon and germanium. Silicon is well known. Germanium is a gray-white, brittle, crystalline metal. Chemically speaking, silicon and germanium are metals, but from a conduction viewpoint they are semi-conductors.

Both of these elements, like carbon, are tetravalent and will form crystals with the same lattice formation as that found in diamond. The difference lies in the strength of the electron pair bonds between the atoms. In either silicon or germanium, the application of light or a moderate amount of heat is sufficient to knock some of the electrons out of their positions in the crystal structure. An electron freed in this manner is then mobile, and capable of acting as a current carrier. The release of such an electron leaves a vacant space in the crystal lattice.

Since an electron has been removed, this space or "hole" as it is called, has a net positive charge. This hole can move. Consider for a moment once again the lower floor of our garage. Suppose that all of the spaces are filled except one, a car to the right of this space moves one car to the left. The space then has moved one car length to the right. By repeating this process the space can move in steps all the way down the line of cars. In the same way a *hole* can move through a semi-conductor by being displaced by nearby electrons.

Unlike a metal, where the density of the current carriers affects the potential of the metal, and hence must remain relatively constant, in a semi-conductor there is no such

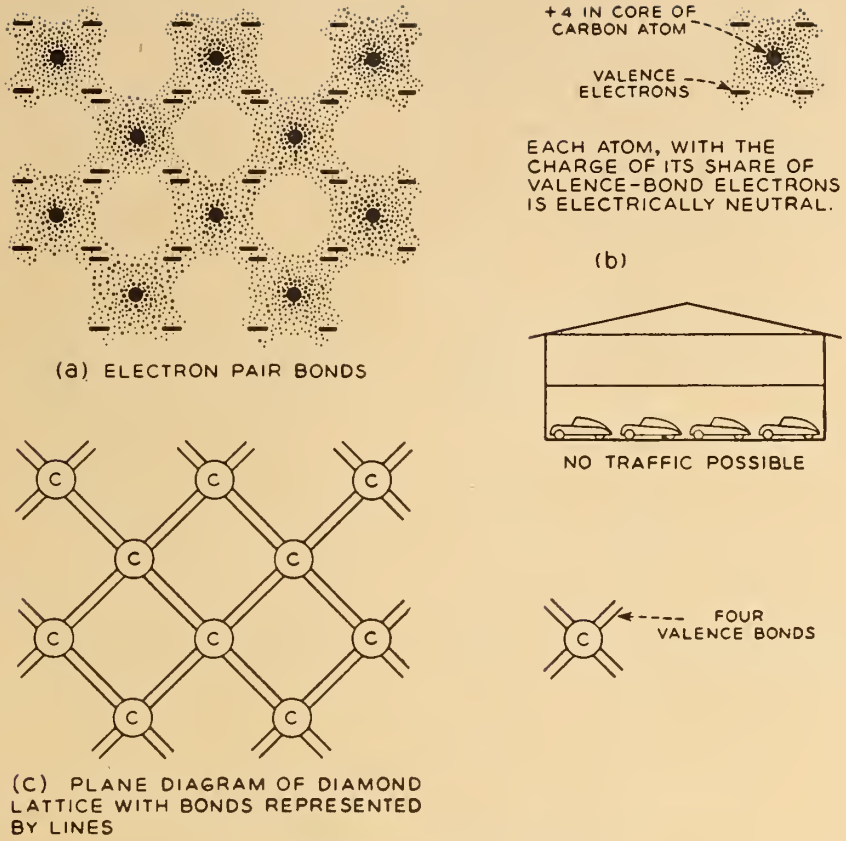

Fig. 1. Electrons in the diamond structure.

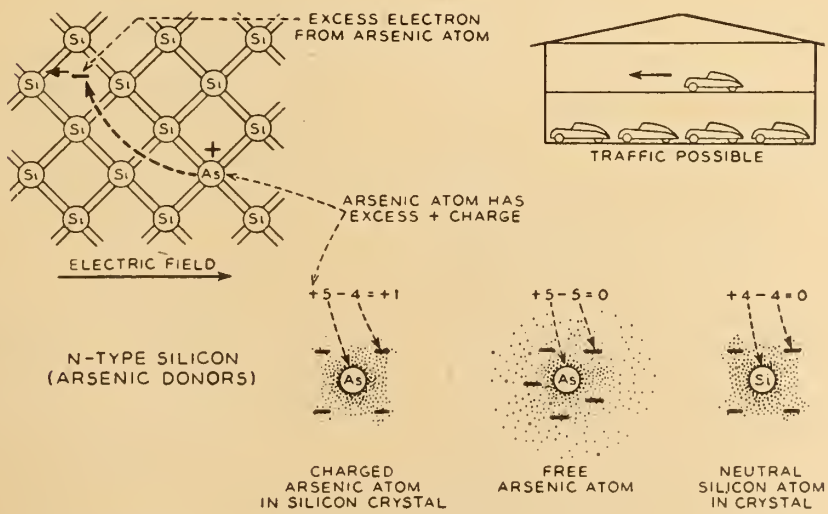

Fig. 2. Excess or electron conduction in silicon containing arsenic.

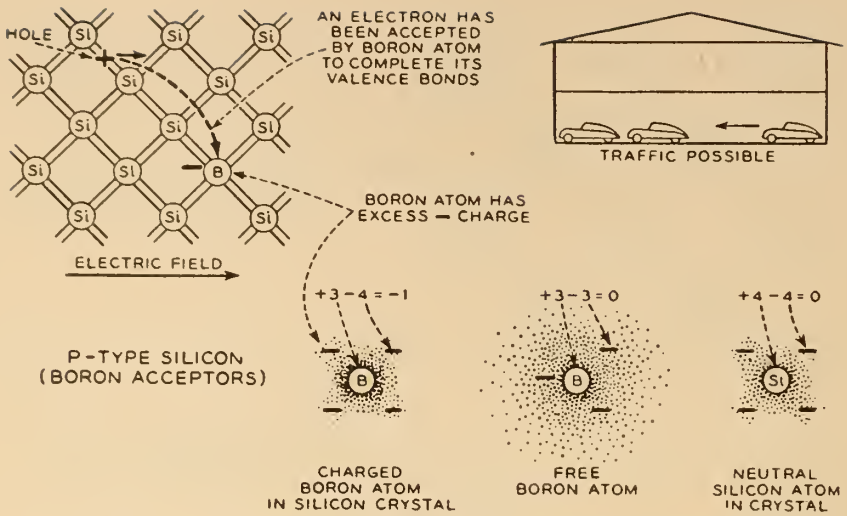

Fig. 3. Defect or hole conduction in silicon containing boron.

requirement. Since two types of current carriers can exist, the potential, in any region, is determined by the difference in densities of positive and negative charges.

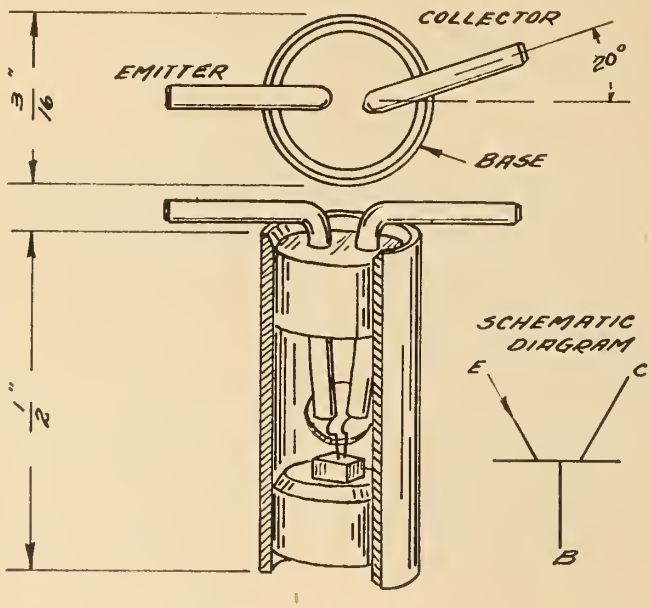

Fig. 4. Cutaway view of a cartridge type point-contact transistor.

Three General Types

We can classify semi-conductors into three types:

(1) The type we have just considered, where a hole is produced for each electron freed, or where the distribution of holes and electrons is approximately 50-50. (A semi-conductor of this type is called an "intrinsic semi-conductor".)

(2) When the number of electrons is greater than the number of holes, conduction is chiefly by these excess electrons. Thus the semi-conductor is referred to as an "Excess" or "N-Type semi-conductor", *N* designating the negative charge of the major current carriers.

(3) When the number of electrons is less than the number of holes, conduction is chiefly by "holes" or electron deficiencies, and the semi-conductor is referred to as a "Defect" or P-Type Semi-Conductor *P* again designating the charge of the major current carriers—in this case *positive*).

How do these N-type and P-type semi-conductors come to be? How can you have more of one type of carrier than the other? The answer is impurities, and these types are sometimes referred to as "impurity semi-conductors".

If we substitute for one of the atoms in a crystal or silicon, an atom with five valence electrons, four of these electrons will be involved in the crystal structure leaving one excess electron. This electron is very weakly attached to its parent atom by virtue of the positive charge on the nucleus. However, the thermal effect of room temperature is sufficient to remove it from the parent atom. Note that the positive charge resulting from the formation of this free electron is not mobile. Thus an N-type semi-conductor is produced (Fig. 2). Here we have an arsenic atom in the crystal structure. The free electron is equivalent to the single car shown on the upper floor of our garage. Traffic is possible on the upper floor but not on the lower.

The explanation of P-type semi-conductors is very similar. In Figure 3 we show a boron atom (which has three valence electrons) in the silicon crystal. Since it has insufficient valence electrons to fulfil its obligations to its neighbours, the silicons, a hole is formed. This hole may move away from its parent atom at room temperature, but in doing so, it leaves the boron atom with an extra electron so there is again a weak link, in this case, between the *positively* charged current carrier and its *negatively* charged parent atom. There are no free electrons produced, so the upper floor of our garage is empty. In the lower floor, however, a space exists which is free to move as I described a few minutes ago.

What Constitutes a Transistor?

Briefly, a transistor consists of two rectifying junctions located very

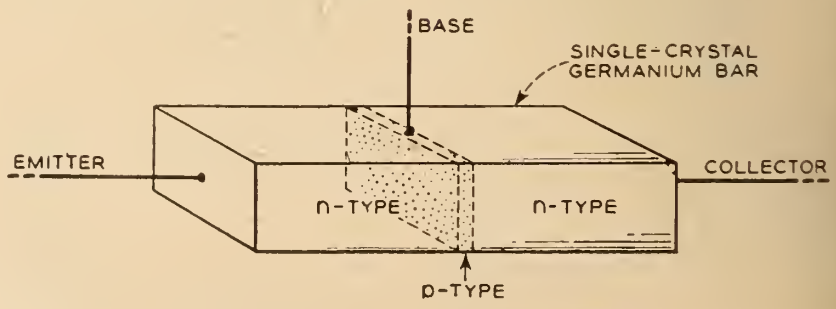

Fig. 5. The heart of an N-P-N transistor.

close together, in or on a semi-conductor. First let us examine the physical structure of the transistor. Basically, there are two types: (1) The *point contact type transistor* (in which the junctions are at the surface of the semi-conductor), and (2) The *junction-type transistor* (where the junctions are in the body of the semi-conductor).

Figure 4 shows a point contact type transistor. Type "A" refers to the mechanical arrangement. The heart of the transistor is a tiny wafer of N or P type germanium (Fig. 5). Germanium is used because it makes better transistors. Silicon transistors have also been made. This wafer is firmly fastened to, and makes good electrical contact with, this metal plug and is connected, through it, to the metal cylinder. This electrode is called the base.

Two cats' whiskers of phosphor bronze are located on the upper surface of the germanium wafer. These are each two thousandths of an inch in diameter at their tips, and are located two thousandths of an inch apart on the surface of the wafer. These electrodes are referred to as the "emitter" and the "collector". The collector is offset from the axis for purposes of identification. You also see, here, the circuit symbol that has been adopted for the designation of transistors on schematic diagrams.

The junction type of transistor is shown on Fig. 5, and consists of a single crystal bar of germanium, enclosed in a plastic bead. Through the centre of this bar is a layer about one thousandth of an inch in thickness having the opposite type of conductivity to that found elsewhere in the crystal. In the example shown, this layer is P-type and the remainder N-type—forming an N-P-N transistor. Three connections are made to the crystal as shown in this diagram, corresponding to the three electrodes of the point contact type transistor. These connections to the crystal are large area, non-rectifying contacts.

These are the two basic types of transistors. Two other types might be mentioned which are outgrowths of the point contact transistor:

(1) *The Coaxial Transistor*—This is similar in construction and characteristics, to the point contact transistor, except the cats' whiskers are located on opposite sides of the germanium wafer. The thickness of the wafer at the point of contact is about three thousandths of an inch. The base connection is made to the periphery of the germanium wafer and connects to the cylindrical metal housing. Axial terminals for the emitter and collector facilitate application to coaxial cable circuits.

(2) *The Photo Transistor*—This looks like one half of a coaxial transistor. There is no emitter. Light falling on the open side of the germanium wafer controls the current drawn from the opposite side by the collector.

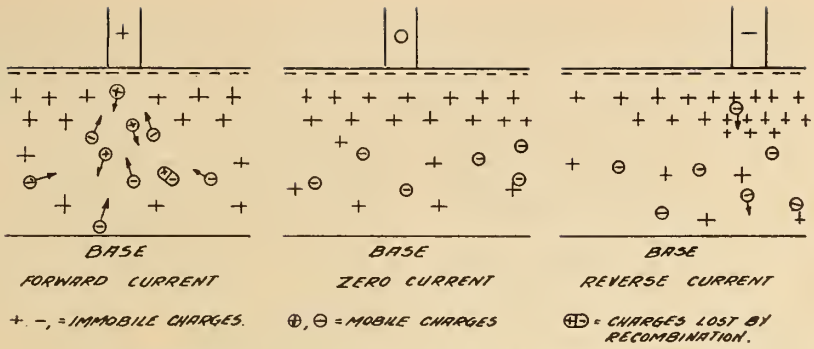

Fig. 6. Diagram of distribution of holes and electrons in point contact arrangement.

How Does a Transistor Work?

Here we must consider again those little holes and electrons. As the explanation for the point contact

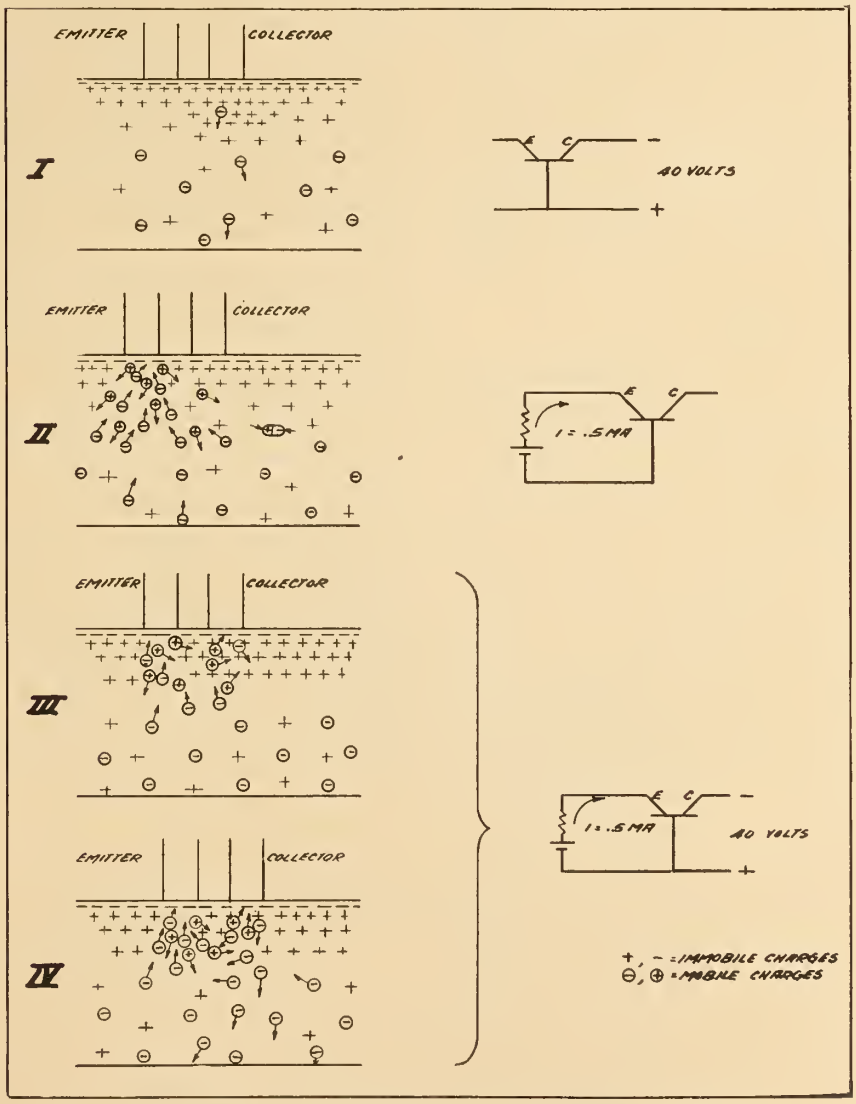

Fig. 7. Diagram showing flow of electrons and holes in relation to emitter and collector.

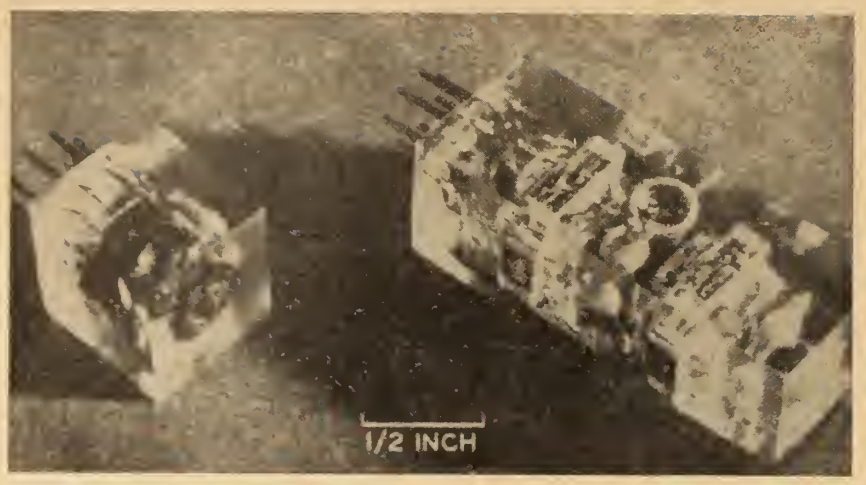

Fig. 8. Left, the micro-power audio oscillator. Right, two-stage transistor amplifier.

transistors is somewhat different to that for the junction type, I will treat them separately. First, then, the point contact transistor.

Consider a crystal of N-type germanium—or silicon. The inter-atomic bonds are not complete. The excess valence electrons are trapped at the surface, and form a layer having negative charge. This charged layer repels the free electrons from the region immediately below the surface into the body of the crystal. There are left in this region the positively charged impurity atoms. Furthermore, this region exhibits all the properties of a P-type semi-conductor except there are no holes.

Now let us apply one point contact to the surface of this germanium crystal. In Fig. 6 we see in diagrammatic form the distribution of holes and electrons in such an arrangement with various potentials applied to the point contact. In the centre we see the conditions with no voltage applied to the point contact. Here, we have the negatively charged surface film. Immediately below that, we have the region free of mobile electrons and below that again, the main body of the N-type semi-conductor with its free electrons. The circles shown around these charges indicate that they are mobile.

If, now, we make the point contact negative in potential with respect to the crystal, we produce the effect shown in the right hand picture. The region which is free of electrons has been deepened somewhat, owing to the effective increase in the negative potential of the surface at the point of contact. This region exhibits high resistance to the flow of electrons and only a few of these will be able to flow from the point contact to the crystal.

Let us now reverse the polarity of the point contact. The effect of the negatively charged surface film is nullified over a small region as shown in the view on the left. A large current flows, consisting of both electrons flowing *from* the semi-conductor *into* the point contact and "holes", generated at the metal-to-semi-conductor interface, flowing *into* the semi-conductor and eventually combining with excess electrons to disappear from the picture. Thus we have rectification —low resistance in one direction and high resistance in the other.

Now let us place two of these contacts in close proximity on the surface of the crystal (Fig. 7). Here are the conditions just described. In this diagram we see the conditions with one electrode connected to a positive voltage and the other to a negative voltage. Both voltages, of course, being referred to the body of the crystal or the base.

The hole current from the positive contact will flow directly to the negative contact through the N-type conduction region immediately below the surface. But this flow of holes has a positive charge and will therefore nullify the effect of the surface charge and attract the mobile electrons to this region, thus increasing the conductivity in its vicinity. This enables the flow of electrons from the negative contact to increase. The contact emitting holes is called the "emitter", and the other contact the "collector".

Thus we can state, for a point contact type transistor using N-type germanium, that amplification results from the modulation of the conductivity of the semi-conductor in the vicinity of the collector—by the flow of holes from the emitter. Current amplifications of the order of 3 or 4 times have been obtained. This sounds rather low. However, the emitter has a very low negative impedance and the collector a very high impedance, so that even with a current amplification of *one*, a considerable voltage amplification can be obtained.

Junction Type Transistor

The explanation for the junction type transistor action can now be given in a few words. Consider once again this view of the N-P-N form of junction transistor. Note that the base here is P-type instead of N-type, as in the point contact transistor just covered. We will have to reverse the signs on our current carriers and voltages.

The conductivity of the emitter region is made much higher than that of the base region. That is to say, the electron density in the emitter is much greater than the density of holes in the base. With the emitter biased negative with respect to the base and the collector biased positive, these voltages manifest themselves as gradients at the transition regions between opposite conductivity types. There is no voltage gradient across the base region.

Electrons from the emitter are drawn across the junction into the base. The flow of holes in the reverse direction is much smaller, due to the low density of holes in the base. Most of the electrons which reach the base region are transported by

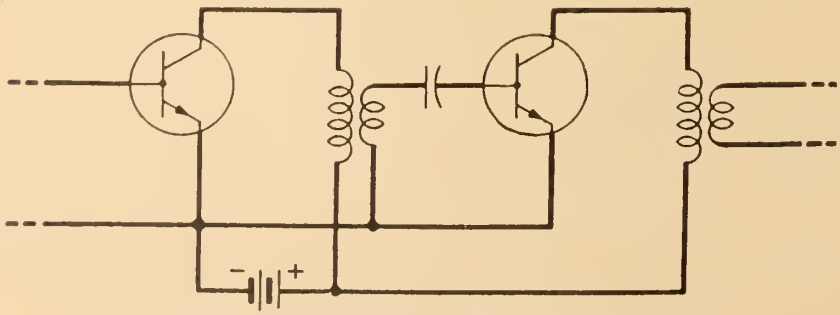

Fig. 9. Circuit of two-stage transistor audio amplifier.

diffusion or random motion, to the opposite side of the base. Here they become trapped by the voltage gradient due to the collector bias and become the output current. Obviously, in this type of transistor, the current gain, with the base grounded, can never be greater than one, and in fact, is always less than one. However, the power gain obtainable with this type of transistor is greater than that obtainable with a point contact type. This is because the ratio between output impedance and input impedance in the junction transistor is extremely high.

In a few words, for the junction transistor the current that is fed into the very low impedance emitter is available at the collector at a very much higher impedance. That then, in simplified form, is the theory of operation of the transistor.

What Can the Transistor Do?

Basically, the transistor is an amplifier, and it makes a very efficient amplifier. Because it amplifies it may be used as an oscillator, modulator, mutlivibrator, or any of the other applications of amplifiers. Since its transfer characteristic is non-linear (in the region of zero emitter current) it can also act as a demodulator or detector. A special point contact type transistor has been described in the October 1949 issue of *Electronics* by R.W. Haegele, of Sylvania Electric Products, which has two emitters instead of one. Mr. Haegele states that this transistor is capable of performing the function of mixer or first detector in a super-heterodyne radio receiver.

Briefly, the transistor is capable of performing practically all of the functions of the vacuum tube with, at the present time, certain limitations. These are:—

1. *Limited Frequency Response:* The maximum frequency at which point contact type transistors will supply a useful amount of gain is of the order of 10 to 20 megacycles per second. The junction type transistor is, at present, less efficient in this respect. This is due to the capacity between the collector and the base.
2. *Noise Level:* While the noise level in point contact transistors is considerably higher than that of the average vacuum tube, the junction transistors are about equal to the vacuum tube in this respect.
3. *Power Output:* Most of the research so far has been directed at the low power type of transistor. However, a junction type transistor has been made which is capable, as a Class A amplifier, of delivering two watts of undistorted power with, incidentally, an efficiency of 48 or 49 per cent out of a possible 50 per cent. The limit on power output has not yet been reached. This phase will most certainly be exploited when those on the research staff of the Bell Telephone Laboratories succeed in improving the low power transistor to their satisfaction.

Specific Applications

An experimental radio receiver has been constructed using transistors and semi-conductor diodes exclusively. Its operation has proved quite satisfactory.

Phototransistors, feeding into transistor amplifiers, are used in a card translator, which is to play a major role in the new nation-wide toll dialling. This card translator selects, automatically, the best channel along which to route a long distance telephone call.

The transistor is a natural for electronic computers. Its small size, low power requirements and reliability, should make possible much smaller computers. These computers at the present time use thousands of vacuum tubes, and dissipate an enormous amount of wasted heat.

The transistor will also find many applications in military equipment. The improvement which can be realized in the size, weight and reliability of such items as aircraft radio and radar (portable radio sets), and electronic equipment for guided missiles (to mention but a few of these applications) will certainly be warmly welcomed by the services.

Let us conclude this section with a description of an amplifier and an oscillator. In Figure 8 we have a two-stage transistor audio amplifier, which provides a power gain of one billion or 90 decibels. The audio oscillator is capable of operating from a supply of one tenth of a volt, and draws six micro-amperes of current.—a total power requirement of less than one millionth of a watt. The transistors, the transformers and coupling condenser can be noted. The units are embedded in a clear plastic. Fig. 9 shows the schematic diagram of the two-stage transistor amplifier. Note that the emitters of the two transistors are grounded instead of the bases.

The Transistor vs. The Vacuum Tube?

As the transistor has no heater or filament, it consumes less power than the vacuum tube. Also, the transistor is ready for duty the

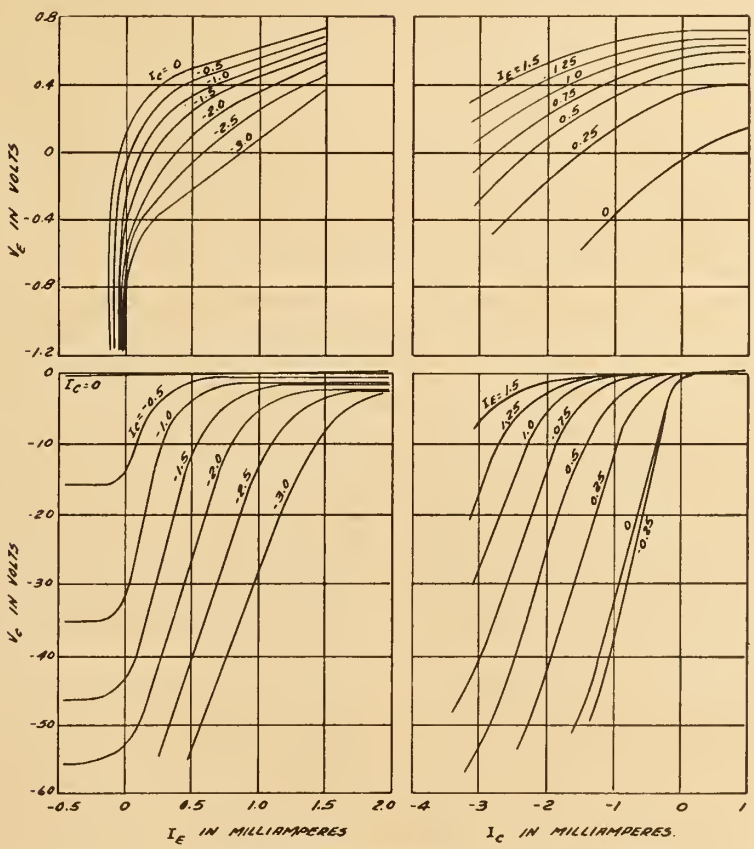

Fig. 10. Static characteristics of point-contact transistors

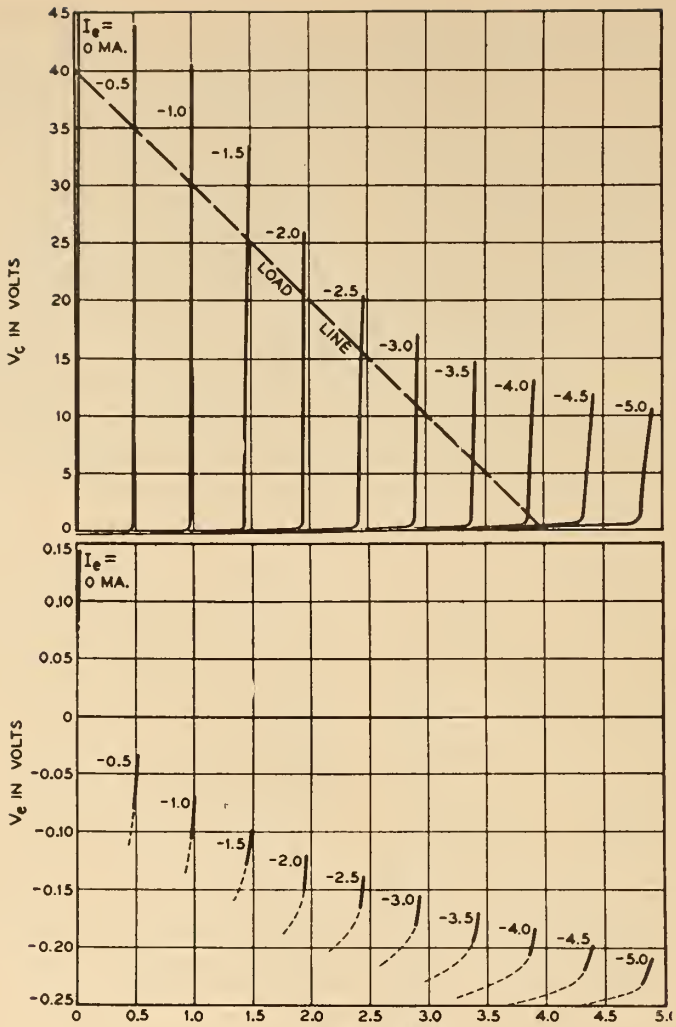

Fig. 11. Static characteristics of an N-P-N transistor.

instant the supply voltage is connected. In a vacuum tube, the grid voltage exerts a control over the plate current. In a transistor of the point contact type, the emitter current exerts a control over the collector voltage. In other words, the vacuum tube is voltage-controlled, and the point contact transistor is current-controlled.

This means that, although the point contact transistor will work in many circuits designed for vacuum tubes, it is necessary, in order to realize the maximum efficiency, to redesign these circuits. A technique has been developed which enables the translation of vacuum tube circuits into circuits suitable for the point contact transistor.

This technique is based on "duality". Every electrical quantity or device has a "dual" and the relationship is mutual. For example—the dual of voltage is current. Therefore the dual of current is voltage. A dual might be considered as a sort of electrical opposite. Other examples of duals are as follows:

Inductance is the dual of capacitance. Conductance is the dual of resistance. A constant current source — a constant voltage source (for ex. battery) Parallel circuit—series circuit. And, the *transistor* is the dual of the *vacuum tube.*

Using relationships based on these and other "dualities", it becomes a relatively simple matter to convert existing vacuum tube circuits to equally efficient transistor circuits. Further information on duality and its application may be found in the Bell System Technical Journal of April 1951, in the article "Duality as a guide to transistor circuit design" by R. L. Wallace and G. Raisbeck. A condensed version of this, entitled simply "Transistor Circuit Design" by Raisbeck appeared in the December 1951 issue of *Electronics.*

The junction type transistor, on the other hand, will operate quite efficiently under voltage control, with the emitter grounded and the signal applied to the base. Little circuit redesign is necessary when replacing a vacuum tube with a transistor of this type. Indeed this type of transistor bears a close resemblance to the vacuum tube if we consider the base as the grid, the emitter as the cathode and the collector as the plate.

The transistor has no vacuum. The elimination of the expensive process of removing all the gas from inside a glass envelope (as is required in the vacuum tube) will mean a great deal in the manufacture, and therefore in the cost of transistors.

The transistor as you have seen, is smaller than any commercially available vacuum tube. Fig. 10 shows the characteristic curves of transistors. First the point contact type. Those of you familiar with vacuum tube characteristics will note the similarity of this set of curves to the grid voltage, plate current, current curves for a vacuum tube, especially if we turn them around. Fig. 11 shows the curves for the junction type transistor.

Conclusions

In conclusion, let us sum up the salient features of the transistor.

Noise Level. The transistor is now about equal to the vacuum tube in this respect.

It has high gain. Its power handling capacity is two watts or more.

High Efficiency. For example, the 2-watt amplifier mentioned had an efficiency of 97 per cent of the calculated maximum for Class A amplification. This is better than the average vacuum tube.

Ruggedness. The junction type transistor will withstand shocks of several thousand G's without damage. Here the transistor excels the vacuum tube very considerably. Being of such a rugged nature it is virtually free from microphonic noise. Many vacuum tubes suffer from this trouble—this is what causes the noise in a radio loudspeaker when one of the tubes is jarred.

Reliability. Expectant life figures are now of the order of 70,000 hours. Better than ten times that of vacuum tubes.

Response. The transistor at the present time has a more limited frequency response than that of the vacuum tube. Note that I said—at the present time—the Bell Telephone Laboratories are still optimistic.

Amplification. Operation with exceedingly small power consumption. To amplify a signal to the level of a few milliwatts the power require-

(*Continued on page 733*)

MANAGEMENT'S RESPONSIBILITY for TRAINING

by

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A paper presented before the joint meeting of the Montreal Branch of The Engineering Institute of Canada and The Canadian Industrial Trainers' Association, December 4, 1951.

We will agree that the owner of a big league ball club would be foolish to expect to win a pennant with players who never practised and with no coach, no farm clubs, and no scouts. Yet many companies try to run without a thorough training program, without a fully qualified training director, and making no effort to attract and hold good men. Competition is equally keen in both fields. A second-rate company loses customers just as fast as a second-rate team loses fans.

In some cases managements have not realized the importance of training; in others they seem to feel that training can be delegated to a training department and that they may then forget about it. Such an attitude makes effective training impossible. Probably the biggest job of a training director is to obtain the wholehearted support and participation of all levels of management in training activities. Until we can convince management that training is an integral part of every supervisory job, our efforts will count for little: before long we will lose paying customers and be back in the bush league.

Acceptance of training is directly related to the evolution of management philosophy. In a recent poll conducted by the American Management Association, a cross section of executives was asked: "What is the most significant change in management during the last twenty years ?" While the answers were differently phrased, each stressed the changes that had taken place in management philosophy. The evolution seems to have progressed somewhat along these lines:

Savagery—The other fellow is my enemy and to be destroyed.

Slavery—The other fellow is to be conquered and put to my service.

This paper was delivered in December last before a joint meeting of the Montreal Branch and the Canadian Industrial Trainers' Association. Mr. Stewart writes from long association with the training programs of Canadian Industries Limited.

Servitude—The other fellow is to serve me for a consideration and ask no more.

Welfare—The other fellow should be helped up when down, without too much concern as to what got him down.

Paternalism—The other fellow should be cared for as I decide.

Participation—The other fellow can help me by contributing to my efforts.

Trusteeship—That for which I am responsible is not mine; I am developing and administering it for the benefit of others.

Statesmanship—The other fellow is capable of being far more than he is, and it is my responsibility to help him develop.

Most firms are well above the lower levels; some may be approaching the very top of the scale. The farther you advance up the scale, the greater is the requirement for and acceptance of training and personnel development.

The first point to make is that training is necessary for the economic survival of a company. Management's prime responsibility is to perpetuate the company as a profitable enterprise for the owners. Thus management must assure itself of a continuing supply of well qualified men to fill all the positions in the company. This does not mean only the top executive positions; replacements should be ready at all levels in the line and staff supervisory groups and also for the senior operating, clerical and sales jobs. The experience and know-how possessed by employees are the most valuable assets of any company, and they can be increased through training. A company which does not realize the importance of and need for training may find that it has overlooked one of the vital conditions of economic survival.

The second reason for the need for training is the current shortage of trained personnel. In the depression years there was little need for training, as few companies were expanding. A person stayed on the same job for years and generally became familiar with the next job in line. Unguided learning is slow and results in little improvement in methods.

When the war broke out and munition plants required thousands of new workers, training became a must. There was widespread use of the packaged training programs promoted for specific needs by Training Within Industry in the United States and by the Federal and Provincial Governments in Canada. Training objectives were broadened for both production and supervisory employees to include the development of attitudes and understandings as well as physical skills.

Since the war, industry has continued to expand at a high rate; with this expansion it has become harder and harder to find people qualified to fill vacancies. This shortage is apparent from the posi-

tions advertised in the daily papers, and in the scarcity of young engineers and skilled tradesmen. Once you could be pretty sure that the next in line would be able to "fill in" or "get by". Now you often find that he has left to accept a better position with your competitor.

Increased specialization within industry calls for more training. It is necessary to have a regular plan for moving people about to give them a chance to acquire broad experience and to fit them for greater responsibility. This training of promising people is necessary at all levels in any organization. If our present employees see that we are interested in training them and if we give them opportunities to advance, they will be satisfied that their future lies with us.

A further reason for an extended appreciation of training is that the more effective use of personnel is the best way to increase productivity. The trial and error method of training is slow and inefficient. When a junior is hired and left for a few days with the person to be replaced, he can learn only a little of what the incumbent knows. The short cuts and easy ways are learned, but the reasons and correct procedures are not established.

It was probably the Hawthorne experiment conducted by the Western Electric Co. in 1927 that first opened industry's eyes to the potential increase which could be made in production when employees were treated as people and when they were interested in their work. In this experiment girl "guinea pigs" were established as a separate test unit. A series of changes was made in working conditions and in the type of supervision. With each change, production went up. It became apparent that the girls were pleased at the attention they got, that they developed great interest in their work, and so went right on breaking records, even when more difficult conditions arose.

Peter Drucker in his latest book, "The New Society", points out that Henry Ford, in establishing mass production, did not make one mechanical invention or discovery; it was his concept of human organization for work that was new. He used specialization and integration to break down the job into small parts, which were then combined and fed into the system at the right place and rate. The production obtained revolutionized industry.

During the last war it was amazing how quickly people off farms, and even housewives, could be taught to do useful work in war plants through proper training methods. The armed forces also developed excellent methods for training troops, skilled technicians and field officers.

In industry, machinery and processes have received intensive study and have been brought to a high degree of efficiency. It now remains to develop personnel with the same thoroughness; the results will be just as rewarding. Money spent on developing machines may be lost through obsolescence, but money spent in training personnel is a continuing asset.

When we look ahead we see another reason why training must increase—the long period of partial mobilization or armed truce that faces us. The only hope of curtailing inflation and other economic tensions is to produce enough goods for both military and civilian demands. This can be done only by major increases in production. To accomplish these major increases we will have to be on the lookout for new ideas and show a willingness to junk the old and adopt the new. We are riding the crest of the greatest wave of scientific and engineering progress the world has ever known. It will require thorough training to prepare management and workers to accept constant change as the normal state of affairs. Their thinking must be changed, not only to gain willing acceptance and avoid resistance at all levels, but to have all levels actively participating in the improvement.

The next reason for believing in training is a more fundamental one and, for forward-looking managements, it may be the most important. It is a recognition of the growing demand on the part of workers and lower management for participation in the development of policy. This trend has been fostered by the unions and has been made possible by the rapidly rising level of education and self-expression. Recognition of this demand is an indication of the growing maturity of industrial management in a free society. This demand for participation is a healthy one, and may be met on a planned and rational basis. It can be used as the driving force in any personnel development program. While it is necessary to reserve to management decisions affecting the survival and growth of the company, participation in policy development at all levels can become the normal method of management. It provides a perfect two-way communication system.

When we have convinced everybody of the growing importance of training and have obtained their willingness to participate actively, they will want to know the type of training we are advocating. Training can be summed up in two words, "personnel development". We should provide an opportunity for each employee to develop to the limit of his ability. Such a program does not mean that every employee has to be developed as a future president. Employees should be carefully selected and then helped to gain effectiveness in their present and future work through the development of appropriate habits of thought and action, and improvements in skill, knowledge and attitudes. This personnel development program should provide for the continuing growth of each individual. In some of the most progressive and successful companies it has become a philosophy of management.

After a man has been carefully selected and inducted, the training requirements for his job should be established. The supervisor should discuss the program with the man. At the beginning of his service with the company, the employee should be impressed with the idea that his training will be a continuing process. It then becomes a normal state of affairs and new ideas and procedures are accepted as they come along.

If the employee shows promise of accepting more responsible jobs during his initial training he may be selected immediately for further training. A new program should be set up in consultation with him, so that he understands the purpose of each phase of his development. There is a universal tendency to delegate training to older employees on the same job as the newcomer. It is important that as much of the training as possible be done by the supervisor himself. Training must be recognized as a part of each supervisor's job, and each should be held accountable for his performance in this field. Effective training requires activity on the part of the learner, and learning by doing fills this need for active participation.

The general development program should be co-ordinated with the replacement requirements of the organization. Replacements should be developed with sufficient flexibility and in sufficient depth to take care of foreseeable and even some unexpected requirements.

Incidentally, the main job of the training director and his staff should

be administrative, to see that the training of each employee is proceeding on schedule. A card can be set up for each employee showing the training he is to receive and when the various steps should be completed. The training director should also be responsible for instructing leaders for conference and group courses, but should not be expected to conduct the actual training courses himself. Promising first- or second-line supervisors should be used as trainers for two or three years, and then returned to line supervision. Not only will these supervisors be readily accepted by other employees, but the training they have received makes them better supervisors. They gain a thorough knowledge of the subjects they have taught, a broader outlook and confidence in themselves, and are thus better fitted to assume greater responsibilities.

Let us see whether this continuous training will accomplish our objectives and pay off for the employee and the company. The things that make you and me want to do a good job affect other people in the same way. We should not make the mistake of under-estimating the intelligence of the average worker. He is well educated, clear thinking and sensible, with as great an appreciation of most things as the average executive.

Security is probably the most important point to all of us. We want to know that our jobs are safe, that we are going to have steady work, that the business is doing all right.

When an employee realizes that he is being trained for his job, he acquires confidence that he can do that job well and will be secure in it. He sees that other employees are being trained to do efficient jobs and must surely feel that the company will be able to meet competition. The supervisor, while training the employee, has an excellent opportunity to pass on information on the welfare of the company.

While the "castor oil", or "earthquake", or "one shot" approaches to training upset employees, particularly the older ones, and create opposition to the changes, a continuing program will convince employees that they are increasing their security, and will thus gain their support.

Opportunity to advance is an important consideration to the younger employee. Here training is a "natural", as it gives him the required skills he needs for promotion.

A fair, considerate and understanding manager gets much better co-operation and results than a boss who gives arbitrary orders and carries most of the load himself. We want a supervisor who knows his business and can teach us to do ours better. Training supplies both these requirements.

Adequate wages are important. If employees can increase their productivity, then they may expect higher wages. It is also important to have a fair relationship between jobs in the company and similar ones elsewhere.

Employees want to feel that they belong; they want to know how they are doing and that they are doing their part. Everyone does better if he receives recognition as an individual and is treated as a thinking person with worthwhile opinions.

While employees know they have some coverage in case of accident, sickness or old age, they often do not fully understand nor appreciate this protection. Training can give them this understanding and reduce their anxiety for the future.

Good working conditions go hand in hand with a progressive attitude on the part of management. Any management that really is sold on training invariably believes that good working conditions should prevail.

Pride in the company is important to employees. They want to feel that the company is serving a worthwhile purpose and is well regarded in the community. This is a prestige item which can be enhanced by the day-to-day actions of the company, by advertising and by good public relations.

It just means that employees want to feel that the company is—a good place to work.

Besides giving the employees what *they* want, our proposed personnel development program gives management what *it* wants, which is: better management, an organization that is progressive, fast on its feet, and capable; increased production, better trained operators and supervisors assure you of increased production; higher quality, better acceptance of your product and fewer customer complaints; lower costs; fewer accidents; reduced turnover, every employee lost represents an investment in time and money, as well as a disruption in production while obtaining and training replacements; more suggestions from employees for improvements; better morale; better understanding of policies; better union-management relations; and better communications. In summary, training assists management to reach its objective of making the enterprise as profitable as possible.

Thus, training gives to the worker and to management what each wants without taking anything from the other. It enables management to see its people as growing material that can be molded and developed to increase greatly the productivity of the organization.

It is important to have an overall program so that the various phases of training can be developed separately and fitted into the master plan.

A personnel development program may be broken down into the following sections:

Selection, while really not a part of training, is important.

Induction should be done in two stages: first, to get a man started at work; then, after he has got his bearings, a follow-up with information on the welfare plans. For staff or technical personnel this might also extend to sessions on the history, philosophy and organization of the company.

Operator training: the job instructor system of 4-step training is still the best that has been devised. It can be applied to any field and at any level.

Pre-supervisory training: supervisors should be carefully selected and trained before being put in charge of employees. At this stage they are anxious to learn and should be given an opportunity to acquire the leadership skills they will need. A reserve of qualified supervisors is an asset to any company.

Supervisory training is the most productive of all. After the supervisor has learned his responsibilities and job, emphasis should be placed on human relations. He should understand what satisfies human wants, and satisfy these so that employees will willingly do more and better work. The du Pont system, training supervisors en masse and then correcting individual weaknesses, is a useful technique.

Executive development: for the men who are to fill the senior positions in the company, a more thorough training is required. Human relations become increasingly important. Job rotation to broaden a person's experience and outlook is essential, as well as work on committees and with senior officers of the company. Courses being given at some universities, such as Harvard, Western Ontario, Toronto, and the Massachusetts

(*Continued on page 733*)

A "Temporary Zero" Method

of

Simplifying Nomogram Computations

by

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This is a description of a labour-saving method which the writer has never seen described in the literature, useful in preparing nomograms of the common "three-parallel-axes" type. It is presented to engineers in the hope that those who are engaged in the design of alignment charts may thereby be saved part of the tedious calculation usually involved in preparing them.

Computation of numerical values from a formula of the type

$$S_U = m_U [f(U) + k_U] \quad . \; . \; . \; . \quad (1)$$

is required in graduating the axes of the three-parallel-line form of chart. It is assumed here that the constants m_U and k_U have already been adjusted so that S_U, the actual distance to be laid out on the axis for a calibration mark numbered U, is zero when U takes on the lowest value of this variable to appear on the chart. In performing the calculation, simple though it is, the repetitive subtraction of the constant k_U, often negative, becomes tiresome and may easily lead to arithmetical blunders, since the value to be subtracted frequently contains three or four digits.

The engineers' scale, by means of which the plotting is done, can, however, be made to take over a good part of this labour. Although the method could easily be described in terms of general symbols, it is most clearly set forth in a numerical example.

Let us consider this actual case:

$$S_U = 51.8 (\log U - 0.146) \quad . \; . \quad (2)$$

First re-write the equation in the form

$$\begin{aligned} S_U &= 51.8 (\log U - 0.100 - 0.046) \\ &= 51.8 (\log U - 0.100) - (51.8 \times 0.046) \\ &= 51.8 (\log U - 0.100) - 2.39. \end{aligned}$$

Then if we put $S'_U = S_U + 2.39$, we have

$$S'_U = 51.8 (\log U - 0.100) \quad . \; . \quad (3)$$

Now prepare a table for S'_U. Before beginning to plot the values along the U-axis, mark off a "temporary zero" point on the axis, 2.39 units below the point of intersection of the lowest isopleth. Then, setting the zero of the plotting scale at this temporary point, mark off the computed values for S'_U. The first plotted point will clearly be 2.39, which will start the bottom of the actual graduation. The resulting values on the axis will be those for S_U.

The saving of effort by this method can be seen from Tables I and

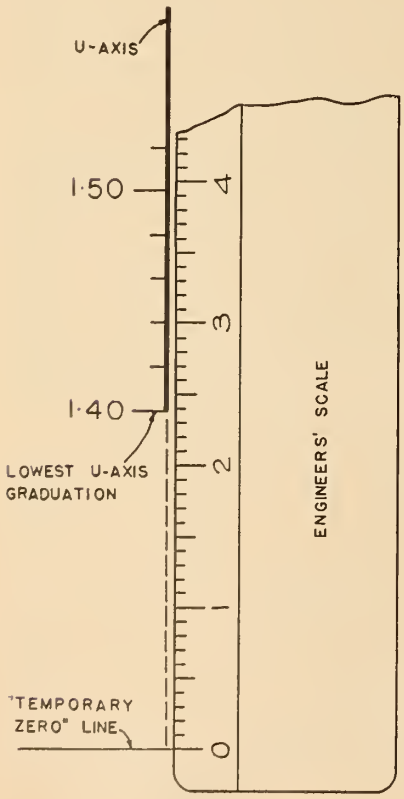

Fig. 1.

TABLE I

1	2	3	4
U	log U	(log U − 0.146)	S_U = 51.8 × Col. 3
1.40	0.146	0.000	0.000
1.42	0.152	0.006	0.311
1.44	0.158	0.012	0.623
1.46	0.164	0.018	0.934
1.48	0.170	0.024	1.245
1.50	0.176	0.030	1.557
....	.....	.....	.....
....	.....	.....	.....

$S_U = 51.8 (\log U - 0.146)$

TABLE II

1	2	3	4
U	log U	(log U − 0.100)	S'_U = 51.8 × Col. 3
1.40	0.146	0.046	2.39
1.42	0.152	0.052	2.70
1.44	0.158	0.058	3.01
1.46	0.164	0.064	3.32
1.48	0.170	0.070	3.63
1.50	0.176	0.076	3.94
....	....	....	....
....	....	....	....

$S'_U = 51.8 (\log U - 0.100)$

II and from Fig. 1. Table I gives the beginning of the standard table for evaluating $S_U = 51.8 (\log U - 0.146)$. Table II shows the simplified scheme for calculating $S'_U = S_U + 2.39$. Clearly, the numbers in Col. 3 in Table II are much easier to calculate than those in the corresponding column of Table I. Fig. 1 exhibits the graphical process.

The advantage of adopting the device is that the recurrent subtractions encountered in the computation are rendered trivial. The scale, instead of the computer, does the bulk of the subtracting work.

A few further examples of the transformation should make the method quite clear.

$$S_V = 21.0 (\log V - \bar{1}.146) \quad . \; . \; (4)$$

becomes

$$S_V = 21.0 (\log V + 0.800) + 1.13 \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; (5)$$

and

$$S_W = 14.1 (\log W - 3.845) \quad . \; . \; (6)$$

becomes

$$S_W = 14.1 (\log W - 4.000) + 2.19 \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; (7)$$

The essence of the artifice is that all but the first digit of the subtracted constant be absorbed into the final added or subtracted figure to be used in plotting.

It may occur to the reader to wonder if all subtraction could not be eliminated from the computation by simply taking the entire second term in the bracket outside, instead of removing only a part of it. A little examination of practical cases will show why this procedure is not feasible. Although a fairly distant "temporary zero" point would not be difficult to use, it must be borne in mind that in actual chart design the product of the initial multiplying constant and the net value of the unmodified bracket must be a fairly small number (usually under 200). It is for this reason that slide-rule multiplication is almost always sufficiently accurate, a considerable advantage to the average computer. The individual terms within the bracket may, however, be large. Completely breaking up the bracket would thus mean that the value of S would appear as a small difference between two large terms, and the slide-rule would not be accurate enough. What must be done is to arrange that there shall be an easily subtracted term left within the bracket, reasonably close to the value of the original constant, so that the net value of the modified bracket will never be large. The computation will thus remain within the capabilities of the slide-rule. √

TRANSISTORS

(*Continued from page 728*)

ment of the transistor is in the order of a few milliwatts. Compare this with the vacuum tube where about one watt or more is required to heat the cathode whether the output is a watt or a millionth of a watt. The transistor oscillator requires an amount of power equal to the energy expended by a flea jumping once every eight seconds. Ridenour in the *Scientific American* refers to this, not as "flea power", but as "lazy flea power".

Future Developments

We can rest assured that bigger and better, and smaller and better transistors will be developed before long by the Bell Laboratories. When these become available in sufficient quantity, what realm of electronics will not feel the impact? We have but to let our imaginations wander over the multitude of potential applications to realize what a *big* thing this little transistor really is.

What does the future hold for such things as the hearing aid—small now, but just think how much smaller it could be—and how much less expensive to operate? Radios may, in future, be available in almost ridiculously small models. A vest pocket public address system has been suggested for the convenience of those who find themselves on a platform without a microphone.

The possibilities are almost without limit. It may even come about that one day, someone will build a Dick Tracy wrist watch radio, powered, not by batteries, but by half a dozen trained fleas in a miniature squirrel-cage.

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MANAGEMENT'S RESPONSIBILITY FOR TRAINING

(*Continued from page 731*)

Institute of Technology permit a broad exchange of knowledge and experience and are filling a very definite need in executive training.

When developing the courses to be given, it is suggested that, together with supervision, you determine the most urgent training needs. These should then be established in order of priority and training courses developed to take care of them.

One of the best sources of information is to find out what other companies are doing. Don't be afraid to pick their brains, you will develop better courses and they will gain in the exchange of ideas. Once you have an outline established, it is relatively simple to adapt it to your own requirements, using your own company information. Concentrate on giving the employees not only the information you want them to have, but information they are interested in obtaining. Don't wait for the perfect course, it hasn't been developed yet. When you have something that is pretty good, get started and improve it as you go along. Otherwise you will find that you are continually postponing training and not obtaining any concrete results. When you have completed one section, move on to the next. Always keep in front of you the master plan and work toward developing better training in all its phases. The downfall of many training programs has been the lack of follow-up. Make it a part of your courses that you have regular refresher and follow-up sessions.

In addition to actual training, it is necessary for the training director and management to make an inventory of necessary replacements. Concurrently, employees should be classified in a schedule of promotability. Thus a close check is kept on "who is required" and "who is available."

When we have achieved all these objectives, we will have a well-trained organization with a good coach, with our first- and second-string supervisory teams, and will be out scouting for promising men. We'll really be right up in the big league pitching with the best of them, and the pennant will be nailed to our mast. √

CANADA'S BANKS in an EXPANDING CANADIAN ECONOMY

by

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Tracing the evolution of Canada's banking system through 150 years to the ten chartered banks functioning today, and outlining how their service is augmented by other financial institutions, the author tells how our banks are administered and discusses their rights and duties under the Bank Act.

An explanation is given of how credit expansion and control is effected and of how the banks control inflation. In conclusion a description is given of the role our banks play in expanding our Canadian economy.

Any student of banking should find plenty to wonder at and admire in Canada's commercial banking system, which today consists of ten chartered banks, with 3,708 branches in Canada. This large number of branches gives Canada a relatively high ratio of bank offices to population. There was one branch for every 3,790 of the population in March, 1951. The corresponding figure for the United States was every 8,000. It is true that the United States, with its unit banking system, had many more separate banks per unit of population; but the significant figure for the comparison of banking services is, of course, the number of bank offices.

The abundant provision of banking services through a multitude of branches has been accomplished with an admirable record for stability and safety. Canada survived the 1930's without a single bank failure, while failures in the United States over the six-month period December 31, 1932, to June 30, 1933, were 3,876.

In addition to branches in Canada, there are 105 branches of Canadian banks in foreign countries. Canadian banks are represented by branches, correspondent banks, or both together, in all important banking and commercial centers. Today Canada's banking system might with some fairness adopt the high-spirited slogans of both great transportation systems: it not only "serves all Canada" but "spans the world".

Canada's Banking History

The development of Canada's banking system into ten banks with many branches is itself the product of a long process extending over a century and a half. As a substitute for an adequate historical outline, we may say that the system passed through three main periods: germination, proliferation, and concentration. After abortive attempts as early as 1792, a charter was finally granted in 1820 to the Bank of New Brunswick in Saint John. But the Bank of Montreal, which secured a charter from the Province of Lower Canada in 1822, had been conducting business as a private association (under the name of "Montreal Bank") since 1817. There followed a period of general expansion during which, in spite of brief periods of recession, the number of banking corporations followed more or less a steady upward trend until 1885 and 1886, when the peak number of 41 was reached. Since then the trend has been as steadily downward until, through failure, winding up, or amalgamation, the number of separate banks had declined by 1931 to the ten chartered banks that we find in Canada today. These banks with their date of founding or chartering, total assets, and number of branches, are as shown in Table I. Our list of course includes only the survivors. Altogether 98 banks have been created in Canada since 1792, of which 39 have failed and 49 have been amalgamated or liquidated.

A certain amount of concentration compared with earlier years has not meant the end of competition in banking. Canada's chartered banks compete with each other. They are part of a financial system which offers, not only complementary, but sometimes competitive financial services. Canada's financial system includes: first, a currency system under direct government control; second, a commercial banking system (the "chartered banks") under central-bank control; third, savings banks, some separate, some integrated as savings departments in the commercial banking system.

It also includes a system of investment banks (called "dealers") to provide, with some help from the chartered banks, the longer term credit based on intermediate and long-term corporate securities (term lending); a rudimentary money market in short-term securities; a peripheral system of lending at various terms provided by trust companies, insurance companies, small-loan companies, and credit unions; and, finally, a number of governmental money and credit institutions in the fields of foreign exchange, industrial development, farm loans, housing loans, and export credit insurance.

These institutions, with minor differences, may be found in most western nations. The spheres of influence accorded to these components of the financial structure reflects specific national conditions, and are usually set by legislation.

Actually, Canadian legislation clearly delimits the role of the chartered banks; and overlapping with the conventional functions of other components in the financial structure is accordingly held to a minimum.

Administration

Turning to the chartered banking system, let us consider first of all what might be called the "static", as opposed to the "dynamic", side of Canadian banking—the legal foundation and administration of the chartered banks. The legal foundation of the chartered banking system is the Bank Act. This act was originally passed in 1871 subject to revision every ten years, the last revision being that of August 15, 1944. Since 1934, the Bank Act has contained clauses to reconcile it with the Bank of Canada Act, which set up Canada's central Bank in that year.

All Canadian banks have the same charter: the current revision of the Bank Act itself. Thus the charters of all the banks run out on the same day every ten years, and must be renewed through the decennial revision and enactment of the Act. The incorporation of any particular bank requires an Act of Incorporation. That Act gives the names of the applicants (who are made provisional directors of the new bank), the amount of capital stock, the name of the bank, and the location of the bank's head office. The minimum capitalization is $500,000, divided into shares of $10 each, with not less than $250,000 paid up. Thus any group with $250,000 cash who satisfy the conditions laid down in the Bank Act can start a new bank at any time.

The central executive function of a chartered bank resides in the head office. The head-office function is essentially non-operating. It consists of creating policy directives, collecting or clearing information, and supervising performance. In a formal sense, there is no actual banking done either at head office or in the various supervisor's departments which perform the head-office function in various areas. Area supervision is done by a district supervisor, who reports to head office either directly or through an assistant general manager or vice-president in his own district.

The branch manager is the one responsible for applying his own ideas, or ideas suggested by head office, to the actual job of attracting deposits and making profitable loans. Discretion granted to the branch manager in the making of loans depends upon the individual case, and varies more or less directly with the size of the branch entrusted to him.

Table I—Canadian Chartered Banks Today

Year Founded or Chartered	Name of Bank	Head Office	Total Assets Nov. '50	No. of Branches Incl. Foreign Nov. '50
1817	Montreal Bank became			
1822	Bank of Montreal	Montreal	$2,190,529,368	568
1832	The Bank of Nova Scotia	Halifax	818,107,524	381
1855	The Bank of Toronto	Toronto	487,156,374	223
1861	La Banque Jacques Cartier became			
1900	La Banque Provinciale du Canada	Montreal	179,157,194	335
1864	Merchants Bank became			
1869	Merchants Bank of Halifax became			
1901	The Royal Bank of Canada	Montreal	2,497,376,342	751
1867	The Canadian Bank of Commerce	Toronto	1,755,317,154	592
1871	The Dominion Bank	Toronto	471,087,438	154
1874	La Banque d'Hochelaga became			
1924	Banque Canadienne Nationale	Montreal	439,550,113	546
1875	Imperial Bank of Canada	Toronto	526,748,659	217
1929	Barclays Bank (Canada)	Montreal	36,479,905	4
			$9,401,510,071	3,781

Loans beyond a certain figure will require approval by his district supervisor. The supervisor in turn will have to refer loans above a certain size to head office for information or approval; and head office, in turn, will submit the larger loans in this group to the board of directors at their weekly meeting. Thus the head-office function is not to make loans but, if necessary, to veto them. The positive side of banking rests for the most part with the branches.

In recent years head office has become more and more active, not so much in making loans as in the investing of funds. A branch in a suburban district with few opporunities to make loans will find that it has "excess deposits"; and this condition may occur in some degree in many branches, even in business areas. Other branches may find that their opportunities to make sound loans exceed in various degrees their ability to get deposits from the public. Traditionally, head office has shifted deposits from the "excess" areas to the areas where they were needed by borrowing excess deposits from branches in the excess area at a fixed rate of interest, and lending them, also at a fixed rate, to other branches in need of loan funds. But in recent years, especially during the war, excess deposits have become chronic, not only for the individual branches but for the bank as a whole.

This has meant that head office is a large net "borrower" from the branches; that is, instead of investing excess deposits indirectly in business loans through its loans to "net-lending" branches, head office has been forced more and more to invest excess deposits directly in government and corporate securities. In this sense, then, head office, through its investment department, gets directly into operations which, if not banking in the traditional sense, do at least go beyond the traditional head-office function.

Rights and Duties Under the Bank Act

What the chartered banks may do.—Any chartered bank is expressly permitted by the Act to "open branches, agencies, and offices"; deal in gold and silver coin and bullion; deal in, discount, and lend against bills of exchange, promissory notes, and other negotiable securities including those of municipal and other corporations. It may also lend against public securities issued by domestic and foreign governments; lend against lien or other notes and conditional sales contracts or similar instruments; and "engage in and carry on such business generally as appertains to the business of banking".

What the chartered banks may not do.—Canadian chartered banks are specifically forbidden to buy, sell or barter goods, or engage in any trade or business; to purchase, deal in, or lend against, its own shares or the shares of any bank; to lend against the mortgage or hypothecation of land, houses, or other immovable property, ships or other vessels, or on the security of "goods, wares and

merchandise", except under Sect. 88 of the Bank Act. They are not permitted to lend more than $1,000 to any officer or employee of the bank without the approval of the directors, and with that approval not more than $10,000; to lend more than 5 per cent of their paid-up capital to any director, or to any company in which the president, general manager, or a director is a partner or shareholder, without the approval of two-thirds of the directors present (the affected director must not be present or voting).

In addition to these specific prohibitions, Canadian chartered banks are no longer allowed to issue bank notes for circulation in Canada. The Bank-Act revision of 1934 provided for a gradual redemption by the banks of their outstanding notes over a period of fifteen years. The elasticity of the Canadian note issue in response to seasonal and other business needs has been much admired in the past by banking experts in various countries of the world. Progressively since 1934 and entirely since January 31, 1950, the Bank of Canada, following central-bank practice in most other countries, has taken over this traditional function of the chartered banking system.

The Bank Act also provides for government supervision of the chartered banks' day-to-day transactions. This supervision ranges in detail and rigour. It includes provision for an independent shareholders' audit, signed annual and monthly returns that must be sent to the Minister of Finance, inspection at any time (and at least once a year) by the Inspector General of Banks, and so on.

In addition, chartered banks are required to hold not less than 5 per cent of their Canadian deposit liabilities in the form of cash reserves. These must consist of deposits with the Bank of Canada and Bank of Canada notes held by the bank. Actually, the chartered banks maintain a conventional reserve in cash of approximately 10 per cent against deposit liabilities in Canada. Reserves rarely fall below the 10 per cent figure; this figure is so well established that the monetary authority is likely to be upset by any marked deviation. Bank of Canada policy is formulated therefore on the expectation based on experience that the chartered banks will maintain a cash reserve of 10 per cent.

Credit Expansion and Control

The fixed reserve ratio is the key to traditional central-bank control over the willingness and ability of the banking system to expand credit, through loans to business and industry. Anything that tends to restrict the amount of chartered bank cash in the form of deposits with the Bank of Canada will induce the banks to adopt a more conservative lending policy. Net sales of government securities by the central bank to the chartered banks and the public will reduce chartered bank cash. The reason for this is that payments by the banks and the public will ultimately take the form of checks drawn on the chartered bank deposits with the central bank. As a result the chartered banks must either replenish their cash position by the sale of other assets, or restrict their loans to the public.

The large chartered-bank holdings of government securities makes this replenishment possible. The central bank may, however, refuse to buy at present prices and allow the price of government securities to fall. The fall in the price of government securities has a two-fold effect: first, it discourages the holder of government bonds from selling, owing to the immediate capital loss sustained when the bonds are sold below their cost to him; second, it encourages the purchase of government bonds by individuals and institutions because, at the lower price, a higher yield can be realized by buying bonds and holding them until maturity.

Both of these effects tend to increase the holdings of government securities by the public, and hence to restrict the amount of chartered bank cash reserves. In recent months the Bank of Canada has adopted this anti-inflationary policy, with the result that government bond prices have fallen, yields have risen, and interest rates in general have moved upward to match the higher yields on government bonds.

But the Bank of Canada does not rely exclusively on this type of credit control. In co-operation with the chartered banks it has set up a program for voluntary credit restriction on the part of the banks and other lenders.* This "qualitative" control of credit is especially effective in a branch banking system. It is far easier to get uniform and effective action with ten chartered-bank head offices than with a multitude of small unit banks. The immense task of securing uniform action throughout Canada is taken off the government's shoulders and shifted to the ten chartered banks, working through their nation-wide organization of branches.

*Since this was written the controls over consumer credit have been removed (May 6, 1952), and the voluntary restriction program of the chartered banks has been discontinued (May 19, 1952).

Our Banking System in Action

As in many other countries, Canada's chartered banks have been forced to adapt in recent years to a rapidly changing economic environment. What passed for post-war "normalcy" after World War I lapsed into deep depression during the early 1930's. The movement to recovery apparent in the late 1930's was soon caught up in the rush and pressure of the war economy. The peculiar problems of the period immediately following World War II brought with them further problems of adaptation, made all the more difficult since June, 1950, by renewed inflationary pressure, arising from the present armament program.

Let us consider, first, the volume of credit and the problem of combating inflation during the present period of defence and rearmament; and, second, the types of loans made and the long-run role of the chartered banks in Canada's expanding economy.

Bank Loans and Inflation.—During 1950 current loans and discounts in Canada increased from $2,173.9 millions to $2,651.1 millions, or just short of 22 per cent. Total loans in Canada increased less sharply, from $2,788.3 millions to $3,316.8 millions, or almost 19 per cent. During the same period the cost of living index rose 10 points, from 161 to 171.1; and the wholesale price index rose 24 points, from 203.8 to 227.9.

Both the increase in the price indices and, to a large extent, the increase in bank loans were symptomatic of certain "real" inflationary factors, some of which are reflected also in certain other figures in the national accounts. For example, a large part of the increase in the Gross National Product from $16,383 millions to $17,693 millions took the form of increased inventories. Inventories increased by $785 millions over the year, and made up the major part of a rise in Gross Home Investment from $3,069 millions to $3,908 millions. Personal expenditure on consumer goods and services rose $663 millions to $11,810 millions for the year, and Government expenditure on goods and services rose $205 millions to reach $2,333 millions. One deflationary factor was an excess of merchandise and service imports over exports, amounting to $316 millions for the year.

Nevertheless, the total effect of Canada's international transactions was to increase inflationary pressure. The current-account deficit of $316 millions was overwhelmed by an inflow of capital, largely from the United States, amounting to over a billion dollars. As a result Canada's official liquid reserves of gold and convertible exchange rose by $695 millions. Expressing it another way, valued in U.S. dollars, Canada's reserves of gold and U.S. dollars rose $625 millions to reach a total of $1,741.7 millions at the end of 1950.

Control of Inflation

Government measures to reduce inflationary pressure through monetary and credit policy took two forms: (1) measures to reduce expenditures by business and consumers; and (2) measures to neutralize the effect of the capital inflow. Both kinds of anti-inflationary measures affected directly or indirectly the activities of Canada's chartered banks.

On the domestic-policy side, three general lines of attack may be distinguished: (1) a move to curtail expenditure on capital and consumption goods by making credit more expensive through higher interest rates; (2) a move to check consumer expenditure on durable goods by the direct curtailment of consumer credit; and (3) a reinforcement of both lines of attack through central-bank policy.

The chartered banks have a part in this program through their restriction of consumer loans to conform to the government's consumer credit regulations regarding the size of down payments, and the terms on which the loans themselves are granted. In addition, the banking system has undertaken to restrict its loans to business as far as possible to essential credit needs, and to limit its over-all lending as closely as possible to the amount outstanding on an agreed target date, February 28, 1951. Current loans in August 1951, at $3,162.8 millions showed some rise from the target date, when they were $2,980 millions. But the rate of rise is considerably lower than in 1950 in spite of an extra demand for credit to finance an unusually large carryover of wheat and to move the large 1951 crop, and of course the increasing credit demands of the defence program.

International Controls

On October 1, 1950, the Government set the Canadian dollar free to find its level on the world market. Throughout the period of capital inflow during the summer, the Bank of Canada sold securities to offset the inflationary effect of the flood of foreign capital. This policy was carried further in the Bank's higher interest rate policy of the succeeding months.

The combined effect of freeing the dollar, plus the central bank's higher interest rate policy, was not only to combat the inflationary effects of the capital inflow. It also served to ensure that the inflow of capital would not be reversed with a higher rate for the Canadian dollar. In the course of the capital flight, Canadian government securities were bought at 90.9 cents U.S. to $1 Canadian. The hope was, that the Canadian dollar would return to parity with the U.S. dollar and the securities could then be sold at a handsome profit.

What happened was that, instead of being raised to parity, the dollar was set free and settled about halfway towards parity, thereby cutting the expected profit. Then the price of government bonds fell as part of the Bank of Canada's higher interest rate policy. Consequently, in the neighbourhood of the ruling rate of exchange on the dollar, the expected profit disappeared entirely. As a result the capital inflow was not reversed. Instead the inflow in 1951 is apparently about as high as it was in 1950. In all this the chartered banks played their part by resuming their traditional pre-war role of exchange dealers in the new free market.

Bank Loans and Canada's Economic Development

Let us turn finally to the long-run role of Canada's chartered banks in the expanding Canadian economy. We shall concentrate on bank lending, even though many of the most valuable services rendered by banks, even in a rapidly expanding economy, may lie in providing newly developed areas with the less spectacular services of safeguarding depositors' funds, clearing and collecting cheques, providing safe-deposit boxes, and the like.

In August, 1951, the chartered banks' total loans in Canada amounted to $3,163 millions. Of this total only $161 millions, or about 5 per cent, were loans to provincial and municipal governments. The rest were loans to persons and business organizations in agriculture, commerce, and industry.

If we use the more detailed figures available for September, 1950, we find that a little over $2½ billions in loans were distributed approximately as follows: 5½ per cent to "government and other public services"; 7 per cent to various financial institutions, such as investment dealers, brokers, trust, loan, mortgage, investment, and insurance companies; 18 per cent in personal loans; and 69 per cent to agricultural, industrial, and commercial enterprises.

Possibly 15 per cent of the banking system's advances are made under section 88 of the Bank Act. Section 88 loans have been especially important in the development of the Canadian economy, because they have provided working capital to many small enterprises in agriculture and industry. These small enterprises, characteristic of a young and growing economy, would otherwise find it difficult to give a lender reasonable security against loss.

Loans under section 88 are made on the security of products of "agriculture, the forest, quarry, and mine, or the sea, lakes, and rivers . . ." and on "manufactured goods, wares, and merchandise in the hands of the manufacturer". Products eligible to provide security under section 88 include such things as threshed grain, seed grain, fertilizer, binder twine, livestock, agricultural implements, agricultural equipment or equipment used in a farm electric system, and various other types of farm improvements, fishing vessels and equipment, and so on.

Other loans to business consist primarily of short-term loans to provide working capital. Lending on longer term to corporations, for expanding plant and equipment, etc., has never developed in Canada to the extent that it has in the United States. In February, 1948, the Bank of Canada requested the chartered banks to stop making loans of this character because of their inflationary effect. In February, 1949, the ban was removed; but it was again imposed in February, 1951, as part of the anti-inflationary program adopted by the Bank of Canada and the chartered banks. In general today, following the rules laid down for credit restrictions, bank loans must not be made for terms longer than one year. The exceptions are farm improvement loans, veterans loans, and oil and gas production loans.

Loaning on Resources

The exception of oil and gas production loans gives the banks freedom to continue their supply of credit to this important frontier of Canadian economic development. Here, again, the banking system has

had to adapt to a new type of lending. Oil loans are made on the strength of oil in the ground, provided the company has one producing well. Usually there is an assignment of the proceeds of production of that well and future successful wells, and loans are made on this basis for the drilling of new wells.

When reports by geologists, concerning the recoverable oil over the loan period, are not too favourable, additional security may be taken; but the basic security is the assignment of proceeds of production. This lending operation resembles section 88 loans; but in the case of oil production loans the bank's security is underground and the bank has to take the expert's word for it that some day, to the relief of both borrower and lender, the oil can be safely and profitably brought to the top. Loans for petroleum and its products, at $22.9 millions, were over twice what they were in 1949. In 1951 the average for the high-production summer months would seem to be somewhat above 1950, and expansion continues.

Much of the capital, both for oil production and for the great developments in iron ore and other strategic metals comes, as it should, from the sale of securities in the capital market. This is the non-inflationary method of economic development based on the savings of the people who buy shares in the enterprise. But the banks can take care of working capital needs, which vary greatly over short periods. In the case of the oil loans, they may provide longer term credit of a special kind where the period of production and the paying out of the loans are longer than the average.

Adaptability

The forces that shaped the Canadian banking system are to be found in an earlier period of Canadian economic growth and increasing political independence. Today the Canadian economy is in another phase of expansion. Canada's banks, conservative as they are and have to be, are nevertheless playing an important part in this new chapter of Canadian economic history. The Canadian banking system has so far adapted itself to economic change without compromising in any way the safety of its depositors' funds. We shall find, I think, that the banking system will continue to prove adaptable to the changing pattern of credit needs in Canada's expanding economy, without fundamental changes in the banking structure itself. √

Nova Scotia Signs Trans-Canada Highway Agreement

The Honourable Robert H. Winters, Minister of Resources and Development, and the Honourable Merrill D. Rawding, Minister of Highways and Public Works, Nova Scotia, announced jointly on May 16 that the Province of Nova Scotia has signed the Trans-Canada Highway Agreement with the Federal Government.

Ontario, Manitoba, Saskatchewan, Alberta, British Columbia and Prince Edward Island signed the Trans-Canada Highway Agreement for the construction of the Highway at a meeting held in Ottawa on April 24, 1950. New Brunswick signed the Agreement on May 27, and Newfoundland became a signatory on June 23, 1950.

The route of the highway in Nova Scotia shall proceed generally from the New Brunswick-Nova Scotia border via Route 4 to the Strait of Canso, crossing the strait via the proposed causeway, and thence to the Newfoundland ferry terminal at North Sydney via a route to be determined as a result of further surveys.

The Trans-Canada Highway in Nova Scotia shall also include that portion of highway from the junction of the West River-Pictou road at Route 4, to Pictou, and thence to the Prince Edward Island ferry terminal at Caribou.

The approximate length of the highway in Nova Scotia will be 310 miles.

Without more detailed survey it is not possible to give a reasonably accurate estimate of the cost involved in the construction of the Trans-Canada Highway in Nova Scotia. From information presently available, and having regard to the average costs across Canada, it is possibly of the order of $24 million of which amount $8 million represents prior construction.

Left to right:—Hon. Robert H. Winters, Minister of Resources and Development, Hon. Merrill D. Rawding, Minister of Highways and Public Works, N.S., and Major-General H. A. Young, M.E.I.C., Deputy Minister of Resources and Development.

Greases from Sand

The idea of using sand as a water-repellent lubricant was put forward and tested recently by the colloids section of National Research Council's Division of Pure Chemistry, and shown to have practical application.

It is, of course, a special form of sand — specially prepared silicon dioxide in a light, fluffy, finely divided form. About 5 per cent of this sand, mixed with a thin lubricating oil, forms a heavy silica grease, of a clear light yellow colour and semi-transparent. The grains of sand are much too small to be seen.

The new product has two advantages over ordinary greases. The first is that silicon dioxide is quite stable at high temperatures, which usually ruin greases by altering their viscosity. The second advantage is that the silica grease has a long bearing life—at least twice as long as that of a good ordinary grease.

Man's Responsibility in the Social and Occupational Realms

by

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A paper specially prepared for presentation at the European Laymen's Conference, Bad Boll, Germany, July 21, 1951.

To be responsible means to be responsible to someone and for someone or something. All of us working on some definite job have to face a purely professional and technical responsibility in the same way as all other men working in the same branch. If, for example, we are professors, we have to be responsible to the university for our students knowing the syllabus, and to the students and their parents for the value of our instruction. If we are members of Parliament, we have to be responsible to our constituents for the fulfilment of the program committed to us. If we are industrialists, we have the responsibility of managing our business, of balancing its budget, and of protecting the interests which are entrusted to us. And we also have to be responsible to our personnel for the working conditions which we impose on them. We are responsible to our clients for the quality of the service which we render them. We can consider ourselves responsible in the same way as all other professional men, whether they be Christian, Jewish or Mohammedan. We usually display a very strict moral professional conscience which business men and the public do appreciate, perhaps because we answer honestly in the language of the world.

Is this enough ? Of course not. Since we all claim some religious belief, we are in the world but not of it, and we have in addition to our purely professional responsibilities, responsibilities of another kind. We have also to be responsible to God, and we have especially to be responsible to Him for all our professional actions, as, in His eyes, our life is one single whole. Therefore, we should try to discover the spiritual significance of our occupation.

Our responsibility to God and our professional responsibility are often in opposition to each other, but these responsibilities are not separate but one and the same.

We may recall that the conditions for carrying responsibility are knowledge, authority and freedom. We can give a correct answer to a question only if we have knowledge of the subject and the authority which makes it possible to give the answer, and if we are free from outside pressure.

We will first of all examine what generally takes place in the industrial world and then consider the changes which occur in personal behaviour resulting from the carrying of spiritual life, even in embryo, into professional problems. In the modern world a great deal is said about responsible people and responsibilities. We prefer to talk about responsibilities rather than live as responsible beings.

We are living in a technical age, and therefore in an age of specialization where almost absolute stress is laid on reason. The difficulty of the problems and the extent to which they are increasing is such that it becomes difficult for a man to turn his whole intelligence fully to more than a part of a problem. Specialists are being trained but fewer and fewer complete men.

Although conditions in France and in Canada are in many ways very different, yet there cannot be much difference in the essentials of human nature there and here. That is why we believe our readers should be interested in reading this condensed version of the views of a leading French engineer on matters not often so frankly discussed in public.

This observation is especially true of the training of engineers. For years they are trained in mathematics, but up to recently in France it was thought unnecessary to make them verify the results of a calculation by physical tests. There is no question of teaching an engineering student about the nature of man. He will become roughly acquainted with this between the ages of 25 and 30, if he works with labour. He will acquire a deeper knowledge of it, if unfortunately he has to come into closer contact with his brothers in war. If he does not make it his concern to meet his neighbour, he will never get to know him, which does not prevent him from dealing almost mathematically, with the living conditions of hundreds or thousands of families. On the other hand, I wonder whether the humanities, as they are taught at present, do not in the majority of cases train specialists, who have a profound knowledge of the man of the past, but who are quite ignorant of the living conditions of the average man in 1951.

Moreover, as our work is divided into water-tight compartments, the practical but distant results of our actions or decisions are hidden from us.

My job as a constructor of dams forces me to accommodate in areas which are often deserts, 1,000 or 2,000 men, for a period of four or five years. In order for this community not to be inhuman, it is advisable to increase as much as possible the proportion of married workers. Quarters for a married worker cost much more than quarters for an unmarried worker. The funds which I have at my disposal for living quarters depend on my contract price and the rate of interest exacted from me by the banker. If I am short of funds, I must increase the number of unmarried workers, knowing quite well and being responsible for the fact that the result will be an increase in the number of brothels around the works. Not all engineers would foresee this consequence of such a decision; it is quite possible that at the same time their wives might be actively engaged in social work among prostitutes.

We are much attached to "authority" in industry. It is impossible to be responsible without authority. It may be based simply on the title or function of a position, this title or function having been conferred merely upon presentation of a document or because the holder belongs to a certain family, caste or party. It would be desirable for it to be founded solely on competence.

Let us acknowledge sincerely that this is not always the case. After the strikes of 1936, I took part in the national commission for wages in the electrical industry as an employers' representative. During preparatory meetings about forty representatives of employers exchanged ideas. I ventured to ask a very simple but delicate question: How many, during their lives, had had direct control of workers ? Such experience seemed to me to be the absolute minimum for knowing the living conditions of the working class. The answer was two only. The workers' delegation was composed of workers who had left their occupations long ago to become union officials, hence somewhat out of touch with the workers themselves. The result of the unsatisfactory composition of the commission was that the question was settled by compromise, because of the clash between the two ideologies, rather than by an objective examination of the problem.

To camouflage lack of real authority, the classic game consists in making shrewd use of the complexity of the modern world. One refers the decision to another person, or better still to a group of persons, by a set of regulations and the procedure becomes mechanical. To illustrate this statement, let us return to my occupation. When an official body has a dam to be constructed, it calls upon a certain number of contractors and asks them to make offers, the limits of which are clearly defined by a specification. This specification retains the right of the owner not to entrust the work to the lowest bidder if his prices are thought to be too low to guarantee the work's being carried out well. During my long career I have never seen the low bidder eliminated. What I have often seen is the matter transferred for decision to a solemn contracts board largely composed of learned people who have perhaps sometimes seen dams under construction in the summer, when all the town goes out to stare at the workers as if they were animals in the zoo — and the one who makes the lowest offer is retained.

This is not a new problem — listen to what Vauban has to say: "17 September 1685, Vauban to Louvois, from Belle-Isle

"There are a few tail ends of work still hanging over from the last few years which are not finished at all and which will never be finished if the contractor's word is taken about it; and all this, my lord, is due to the confusion which is caused by the frequent bargaining which occurs in your works because it is certain that all these broken contracts, promises that are not kept, and renewals of agreements only serve to draw to you as contractors all the wretches who do not know where to lay their heads, all the uninformed and rascals, and to drive away all those who have the means and are capable of carrying out an undertaking. I would say, moreover, that this delays the work and makes it considerably more expensive, and it is done much worse as a result, because these low offers and bargains which are so much sought after are fictitious, so much so that the same thing happens with a contractor who loses as with a man who is drowned: he clings to everything he can; and to cling to all he can in the case of a contractor, means that he does not pay the man from whom he obtains his equipment, that he pays the workers he employs badly, that he cheats those he can, that he has only the worst because they offer themselves more cheaply than the others, that he only uses the lowest quality materials that he can, that he always turns his back on his obligations, that he cheats in his methods, that he disputes over everything and that he always complains about this one and the other, especially about those who wish to force him to do his duty . . .

" . . . And that is enough, my lord, to show you the defects of this method of procedure; so give it up, and, in the name of God, restore good faith; pay the price that the work is worth and do not begrudge a fair wage to the contractor who will fulfil his duty; this will always be the cheapest method you can find. Do not make contracts by the year, but for each separate piece of work; and in short, be as faithful in fulfilling your part as you would have the contractor be in his. But above all, do not accept contractors who are not solvent and intelligent; that is the only way if you wish to be served well. If you do otherwise your work will never be completed and will cost you a third or a quarter more than its value and will give you and those who are concerned in it a thousand anxieties."

To carry out such advice it is necessary to have real authority.

The structure of the modern world is such that our margin of freedom is getting narrower every day. Legal and administrative regulations, scientific organization and the number of controls, make us live in an inflexible world. The concentration of capital and standardized administrative organization implies a centralization which is reducing more and more the number of those who have the power of decision. A few years ago, during the German occupation of France, we organized study circles on general questions: wages, property, work, hierarchy, etc. During the study of wages, some engineers from workshops pointed out that the scale of wages was fixed on the national level, and that they had finally at their disposal only such a small margin of freedom that they did not feel themselves to be at all responsible. I know a large French government bureau where, in theory, the regional director draws up the contracts. In fact, when he has to come to an agreement with the contractor, he has to get the approval of seven departments or controlling bodies.

We are becoming more and more dominated by organization and more development in this direction seems inevitable. There seems to be no human solution to the situation and we are therefore in danger of being deprived of some of the most important of our human qualities. Should we abandon ourselves to this fate ? Certainly not. This would amount to our resignation as men. In my opinion the only effective remedy, enabling us to find life again in this inflexible world, can and should be found in spiritual culture. All religion bids us to set up a healthy hierarchy between human knowledge and divine wisdom.

My occupation employs and creates nomadic workers. It is certain that if I manage to find work for a considerable number of years at one location, I am contributing towards reducing the nomadism and I enable a certain number of workers and their families to become attached to an area and have a more normal life. But the falls which I may find there have to be of value economically when compared, for example, with a fuel power plant which could be constructed at the other end of France.

The thermo-hydraulic comparison is difficult. A general solution of the problem has been arrived at in France by a team of seven engineers. Let us attempt to explain the method. It should be remembered that a hydraulic plant lasts for 100 years, consumes only water and requires few personnel; a thermic plant lasts for only 30 years, consumes coal and requires a large number of personnel. To take these differences into account, additional capital representing present value may be added to the original cost of the

work for the plant, covering maintenance and replacement expenses for the hydraulic plant, and maintenance, replacement and coal consumption expenses for the thermic plant. To arrive at the actual annual expenses, account must be taken of the rate of interest on money for at least 100 years, the life of the hydraulic plant. It is important that the life of each of the machines in question, machines of very different types, should be known. Finally the consumption of coal of an ideal thermic power station should be estimated over a period of 100 years, taking into account technical improvements in fuel utilization which may be made.

Is not this prophesying in the material realm at the very time we know absolutely nothing about what is waiting for us in the immediate future? Am I not entitled to pass judgment on the crazy pretensions of human knowledge and declare that they should be limited? And if the analysis shows 400 or 500 families would be uprooted, is it not my moral duty to disagree with it?

We have seen to what extent professional authority depends on technical competence, on general knowledge based on experience and on character. But this authority is greatly increased by spiritual life and by faith. In expressing this idea, I think especially of two sincere Roman Catholics; one of them the general manager of a large industrial engineering firm, the other, an engineer, the chairman of an engineering union. They never talk about their beliefs, they live them, their "yes" is "yes". This straightforwardness is only a starting point. As a result of their reputation, the first of them was called upon to bring about a reconciliation between two groups of workers at a time when opposing interests forbade any negotiation. As for the second, he was led to take over sole management of a strike in a very large organization, negotiating with the general management, not only for the staff but also for many unions other than his own. This kind of authority does not come from man. When joined with an unwavering professional authority it has great weight.

Freedom of judgment brings with it freedom of decision and of action, which are, however, dependent on the depth of our faith. There are times in professional life when regulations and human laws lead to an impasse. Galiéni and Lyautey used to say that in such cases one should lean on the regulations until they bend. Personally, I think that although we should be subject to authorities and render to Caesar the things that are Caesar's, we should, if we have gained the conviction that the order given by the authorities is in flagrant opposition to moral justice, free ourselves from the authorities having previously warned them when such a warning is possible. This implies challenging the justice of men and taking the risk of putting oneself under the judgment of God alone. The risk is great but we cannot live the life of a man without risks.

During the occupation of France, in order to avoid stoppage of construction I had no hesitation in buying steel that was required for the work from a German officer on the black market. If I had not done so the workers would have been sent to Germany on forced labour. Needless to say I notified neither the French Government of the moment nor the occupying power.

More recently when I had to accommodate 25 families in a large town and had been refused the proper means of doing so, I decided in the end, for the sake of the balance of the family life of my fellow workers and in order to make a speedy start on the program of work which had been entrusted to me, to enter into negotiations with the most doubtful of agents in the housing business that are to be found in a large town and to pay under the counter. In these two cases I was in complete opposition to human law. Was I right? I shall know the answer only later on.

It is impossible to define a general solution of behaviour which can be applied to every case in our professional and social life. First of all, cases differ. For example, in France the problems are different according to whether they concern a worker in a small or in a large industry, different for the smallholder and for the large landed owner and his agricultural worker. Finally and above all, for a given person and in a given case, the solution arrived at depends on his spiritual growth and the depth of his faith at that time.

The problem of saying "no", of giving an absolute refusal to some of the ways of the world, is subjective and depends on our faith. We will be all the more exacting with ourselves if we are spiritually alert and all the stronger to attempt the impossible if we have assurance in our faith. The "no" should logically lead us to failure so far as social success is concerned. This is certainly what makes us afraid and tortures us. The majority of us have no special desire to be martyrs. What is required of us is that we should run the risk. Sometimes doors open contrary to our expectation. It is not we who have opened them. And, also, however paradoxical this may appear, in this feeble modern world, the man who has character through his faith is ultimately much in demand. There are few such men in the world of 1951. It is also possible that the doors do not open and this would be failure according to the world and perhaps even martyrdom. This is the risk; the strength will be given to us, if we ask for it.

There is no general solution, there are only particular problems to be dealt with day by day in the situation in which we are. Does this mean that we should not give our support to those who think that action in accordance with a system and a human plan can lead to justice? Of course not.

I am not unaware of the fact that the calls of the prophets are always relevant, and thirty years of industry and a little history have taught me that in the majority of cases it is by struggling that the unfavoured have obtained and obtain an improvement in their lot. It may therefore be good to give one's support to systematic action. But I also know from experience that the day after a change in structure, men are the same as they were the day before, even if a large number of notable people have been replaced. I have no illusions about any system setting up an earthly paradise.

To conclude, I ask you to read a few sentences pronounced by Karl Marx in London in 1856:

"This contrast between modern industry and knowledge on the one hand, and modern poverty and failings on the other, this contrast between productive forces and the social conditions of our time is an obvious, crushing and undeniable fact. Some political parties may deplore it, others may wish to be freed from modern technical knowledge and at the same time from modern conflicts. Or, they may believe also that such considerable progress in industry, in order to be perfect, requires a no less considerable retreat in the political sphere.

"As for us, we are not taken in by the perfidious spirit which never tires of pointing out all these contradictions to us. We know that the new forces of society demand new men who will master them in order to make a good job of them . . ." √

FROM MONTH TO MONTH

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

World Power Conference

There will be a sectional meeting of the Conference in Rio de Janeiro from July 25th to August 8th, 1954.

A copy of the technical program as prepared by the Brazilian National Committee has been sent to the Institute by the Honorary Secretary of the Canadian Committee, Norman Marr, M.E.I.C., of Ottawa. It is as follows:—

1. Planning of the Electric Power Industry
   - 1.1. Planning of the Electric Power Industry in accordance with the co-ordinated planning of the other economic activities.
   - 1.2. Thermo-Electric Plants as a complement to Hydro-Electric Developments, in regions of abundant water power resources.
2. Uses of Electric Power
   - 2.1. Electric Power and the industrialization of tropical and sub-tropical raw materials.
   - 2.2. Electric Power and the industry of metallic alloys.
3. Energetic Installations
   - 3.1. The influence of tropical and sub-tropical factors in the design of:
     - 3.1.1. Hydro Electric Plants.
     - 3.1.2. Thermo-Electric Plants.
     - 3.1.3. Wind Power Plants.
     - 3.1.4. Installations for the exploitation of Petroleum.
     - 3.1.5. Installations for the exploitation of Solid Combustibles.
     - 3.1.6. Gas Works and installations for the exploitation of Natural Gas.
     - 3.1.7. Installations for the use of Waste Vegetal Residues in the production of steam.
4. Wind Power
   - 4.1. Systematization of observations and studies concerning the use of Wind Power for the production of electric energy.
   - 4.2. The combined operation of Wind Power Plants or Wind Power Electric Plants and Thermo-Electric Plants or Hydro-Electric Developments.
   - 4.3. Wind Power and rural electrification.
5. International Hydro-Electric Developments
   - 5.1. Technical and economic general procedures in Hydro-Electric Developments interesting two or more countries.

UPADI at New Orleans

Upadi is a conference of engineering societies in North, Central and South America. It was founded in 1941 at Havana, Cuba, and is meeting for the second time at New Orleans on August 25th to 30th.

The Engineering Institute of Canada is a member. So also are the following societies in the United States—The American Society of Civil Engineers, The American Institute of Mining & Metallurgical Engineers, The American Society of Mechanical Engineers, The American Institute of Electrical Engineers and the American Institute of Chemical Engineers. There are seventeen members from South and Central America representing these countries; Argentine, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Panama, Paraguay, Peru, Puerto Rico and Uruguay.

Past President James A. Vance is a member of the Board of Directors, and plans to attend the conference.

Cover Picture

Rock blast in preparation for construction of Sir Adam Beck No. 2 Power House of the Ontario Hydro-Electric Power Commission at Queenston, Ontario. — *Photo courtesy Canadian Industries Limited.*

President John B. Stirling also plans to be there. Each member society is entitled to ten delegates. Mr. Vance is in touch with several members of the Institute who are considering attending, but would be interested to hear of more who would be interested in promoting sound relationships with South American organizations or in business relations with South American countries.

The conference will be held at Tulane University, New Orleans, and James Todd, a past president of the American Society of Mechanical Engineers and a resident of New Orleans, heads the North American committee on arrangements.

Any members who might be interested in attending the conference are asked to communicate with Headquarters as soon as possible.

A Day with the Military Engineers

Close collaboration with the engineers in the armed services has been before the Institute for some time. There have been conferences in Ottawa about it; committees have been appointed; conversations and discussions have ensued, and there have been several specific actions taken to bring the objective to pass. The Institute has a special committee under the chairmanship of Commander R. L. Dunsmore of Montreal to develop future policy and activities.

As part of the Institute's interest in the subject it has been the custom for the president to visit the Royal Canadian School of Military Engineering at Chilliwack, B.C. This year Dr. Macnab carried on the custom and spent the day of Friday, May 2nd, at the School. A quite elaborate program of events was inaugurated upon his arrival at 11 a.m. with perfect weather prevailing. Great credit goes to Lt.-Col. F. A. McTavish, the Commandant, and his staff for the day's events and for the many kindnesses and courtesies shown the president and his party. The president was accompanied by R. L. Dunsmore, Professor S. J. de Jong and Stuart Lefeaux, chairman and secretary respectively of the Vancouver Branch and the General Secretary. Several more Institute members from Vancouver came for the evening program.

Upon the president's arrival, the band of the School struck up and put on an informal march past in the president's honour.

Lt.-Col. McTavish received the group in his office and "briefed" them on the day's program. From there the party drove to Melville Camp (so named in honour of Brigadier J. L. Melville, M.E.I.C.). This is located several miles from the school in a delightful valley that would be an ideal place for the fisherman, the hunter or the camper. Incidentally it is an ideal place for a military camp as well which serves as the base for operations still some distance into the mountains.

Melville Camp is all under canvas, but enjoys many features that one wouldn't expect so far from civilization, such as electric power and light and refrigeration for the kitchen. The party had lunch here and met several more officers. It would have been a delightful place to spend the day but the Commandant had other plans, some of them pretty tough to complete.

The next event was a trip by jeep to the "rail head" where the men of the School were building a highway right through the mountains. The ground already cleared and levelled is not yet surfaced and there had been heavy rain for several days. The heavy road making equipment had done a good job of churning up the terra "infirma" so rubber boots were in order. It was well worth the effort, to reach the head of the job and to see what had been accomplished.

The entire project from the first reconnaissance surveys to the final top finish is in the hands of the school. Here men learn how to run survey instruments, operate trucks, derricks, shovels, scrapers, graders and how to repair them. They build their own timber bridges and trestles to a 40-ton loading specification. At the time of the visit a group was busy erecting a heavy timber trestle about 100 ft. long with a grade of about 5 per cent. All around were giant trees and great mountains—the "forest primeval" which is so fast disappearing under the demands of industry. It is indeed rough country but the engineers are pushing ahead and someday will have completed a class one highway right to Chilliwack Lake.

The President visits the R.C.S.M.E., Chilliwack, B.C.

Left. The president's party pose with a group of officers including Lt.-Col. F. A. McTavish; Major S. N. White, a British exchange officer acting as chief instructor; Major W. L. Hough, in charge of Trades and Training Squadron; Major W. E. Blake, administrative officer; Capt. G. V. Kleinteldt, commanding Bridging Troop; Capt. J. H. H. Bell, mess secretary; Lieut. F. C. Swinnard, commandant at Melville Camp; Lieut. A. A. McPherson, commanding Roads and Airfields Troop. Right. The president, Dr. Ira P. Macnab, places a wreath on the Sappers' Cenotaph.

A squad at work on a timber trestle on the Sapper Highway.

Lt.-Col. McTavish, the commandant, welcomes the guests to the Mess Dinner.

Back at Chilliwack the president placed a wreath at the Cenotaph—a granite pylon quarried, designed, cut and erected by the Sappers of the School several years ago. This was a very formal, dignified occasion with a full military ceremony. Four guards stood at the corners, each at the position of "Rest on the Arms Reversed". A bugler sounded the Last Post and Reveille.

Then the party motored to Cultus Lake to see the training on the water. Number one Independent Airborne Troop R.C.E. gave a demonstration of rafting, using wood and steel pontoons and Bailey Bridge sections to build a transport for heavy trucks, the whole being driven and controlled with special outboard motors.

Then followed a quick visit to several buildings where the trades—21 in number—were being taught. Special attention was given to the soil testing being carried out by candidates for senior NCO posts. Among the trades were carpentry, tinsmithing, painting, pattern making, "concreting", plumbing, brick laying, metal working, machinists, electricians, radio technicians, telephony and so on. In bricklaying it was disclosed that after four months' training, most men could lay 800 bricks a day!

Mess Dinner

The big event was the Mess Dinner held in the evening. Lt.-Col. McTavish presided and Dr. Macnab was the guest of honour and speaker. It was a very formal affair, as is the custom, but was most enjoyable. Commander Dunsmore introduced the president. Others at the head table were Major-General John Peter Mackenzie, M.E.I.C. and Brigadier W. J. Megill, D.S.O., C.D.

After the dinner there was a pleasant and informal gathering in the lounge—so pleasant in fact that the president's party did not get back to Vancouver until—well, until a very late hour.

It is too bad that more engineers cannot see around the school and more employers too. A great work is being done there that is valuable not only to the Army but to industry as well, for some of these men, who do not wish to make the army a career, go back to industry after they have had their three years' training. The engineering students who go there for their summer courses receive a practical training that compares well with anything they can get in industry, and in some ways is much better.

An Annual Airing

One of the most impressive and fascinating parts of the Annual Meeting of the Engineering Institute of Canada is closed to all but a handful of fortunate members.

At this function, a group of clear-eyed and clear-thinking fellows take a long look at the Institute and its affairs, and then present to Council an outspoken statement of what's right and what's wrong with the manner in which the "old" men handle the affairs of the "young" men.

Each year, on the day before the official opening of the Annual meeting, the student delegates representing the eleven Canadian engineering universities come together at the Institute's expense to discuss their common problems.

These meetings start under the chairmanship of a member of the Engineering Institute of Canada, and have in attendance, the President and General Secretary of the E.I.C., together with members representing the armed services, industry and consulting. During the first half of the Conference, the students report on their faculty engineering societies, and question the senior members on Institute policy and progress.

Following this preliminary session, the students appoint their own Chairman and carry on further discussions without the "dampening" effect of their seniors.

Finally, they present to Council resolutions for the consideration of the Institute and the various student engineering societies.

Here are some samples from the 1952 Student Conference.

During the past year, Engineering Student Societies have:—

1. killed a thriving Communist front organization by attending en masse and quietly electing a full slate of officers;
2. recognized achievement by presenting honorary awards to their graduates;
3. encouraged membership in their societies by holding freshmen receptions;
4. handled the sale and exchange of technical text books to raise funds;
5. published lecture notes;
6. supported worthwhile charities.

The students are worried about:—

i. the lack of serious appreciation of the profession by students;
ii. apathy towards student organizations, including E.I.C.;

iii. poor lectures;

iv. the lack of financial aid and moral support from the local E.I.C. branches.

The students recommend:—

a. more active guidance work in the high schools and universities;

b. that engineers and students consolidate their various societies instead of weakening the profession by splitting up into rival groups;

c. that engineers and students support and strengthen "Canadian" engineering societies.

These samples of action and thought are ample evidence of the calibre of the following student delegates: Allan Hicks (Chairman), University of British Columbia; A. Majid Ibrahim, University of Alberta; K. R. Fowler, University of Saskatchewan; Norman A. Hanks, University of Manitoba; W. J. Cooper, University of Toronto; G. W. Crook, Queen's University; Cameron Kenney, McGill University; Pierre Brosseau, Ecole Polytechnique; P. E. Begin, Laval University; David M. Baker, Nova Scotia Technical College; James Q. Calkin, University of New Brunswick; P. S. Chisholm, R.M.C. (Observer).

The visiting firemen during the early session were: President, Ira P. Macnab; President-elect, J. B. Stirling; General Secretary, L. Austin Wright; Members, Mr. R. F. Shaw (Senior Chairman), Mr. Irving R. Tait, Col. Alex. McTavish, Mr. Allan S. Gentles, Mr. D. C. MacCallum.

Montreal Engineers Take to Golf

The annual golf day for the Corporation of Professional Engineers of Quebec and the Montreal Branch of the Institute fell this year on Tuesday, June 10th. Some rain fell too but even with a fifty mile gale, the only result was to slow up the tournament. The scene of all this activity was the Lakeshore Golf and Country Club at Lachine. There were 105 playing which is a new record.

A dinner which followed the golf was distinguished for several things but principally for the fact that

Right. The winning smile. Left to right, Roch. Gohier (the winner), E. Gohier, Maurice Gerin, and Taylor Kennedy.

Below. This illustrates the terrors of golf. Also it shows, from left to right: E. R. Smallhorn, A. Turner-Bone, E. N. MacKay and C. F. McNeil.

Right. Nonchalance on the links. This was before the rain storm. Left to right: R. Dansereau, H. M. Esdaile; G. N. Martin, vice-chairman, Montreal Branch; Robert Layton, chairman, Junior Section.

there were no speeches. The only items on the agenda were food and prizes—the former in quantity for all, but the latter for the selected few only, who are:

Low gross: 1. R. Gohier, 80; 2. G. Cunningham, 82; 3. L. Marsh, 82; 4. J. Marier, 83.

Low nett: 1. J. Reed, Gross 96, handicap 24, nett 72; 2. H. Tincombe, gross 91, handicap 18, nett 73; 3. J. M. Mace, gross 97, handicap 23, nett 74; 4. E. Mahon, gross 104, handicap 27, nett 74; 5. R. Edson, gross 114, handicap 40, nett 74; 6. P. Mongeau, gross 114, handicap 40, nett 74.

High gross: H. Esdaile, 132.

If the attendance at this function continues to increase as it has up to now, something will need to be done shortly about accommodation. Who knows—maybe it will become a two-day show?

More About the Centennial of Engineering

CENTENNIAL OF ENGINEERING 1852 1952

In the March issue of the *Journal* (Page 215) there was a reference to the celebration of the 100th anniversary of the founding of the American Society of Civil Engineers. That article concluded with a statement that a draft of the program would appear in a later issue.

Since then a schedule of meetings has been received at Headquarters, which indicates conclusively that to present the whole program would require a complete issue of the *Journal*. There will be fifty-eight American societies participating and the meetings of fifty-five of them are shown in the schedule, totalling 187 technical sessions each of a half day duration. Anyone will agree that it is not reasonable to publish the whole program in the *Journal*.

In the hope that it will enable Institute members to select the dates for their visit to Chicago, the *Journal* is publishing herewith a list of those societies whose activities would seem to come closest to Canadian interests, and the days they will be meeting. There are 26 of them. Full details of the actual program can be obtained from the society headquarters.

Some of the events of interest to special groups in the Institute are the annual meeting of E.C.P.D., the regional meetings of the International Management Congress (C.I.O.S.), the World Power Conference, the International Commission on Large Dams, and the International Commission on Irrigation and Drainage.

In addition to Canada thirteen other nations will participate officially. They are Norway, Belgium, Great Britain, Japan, France, the Netherlands, Switzerland, Italy, India, Mexico, Cuba, Peru and Uruguay.

The British delegation will include the presidents and secretaries of the three leading institutions — The Institution of Civil Engineers, A. S. Quartermaine, C.B.E., M.C., president, E. Graham Clark, secretary; The Institution of Mechanical Engineers, Sir David Pye, president, Brian G. Robbin, secretary; The Institution of Electrical Engineers, Sir John Hacking, president, W. K. Brasher, secretary. At the conclusion of the Centenary, these distinguished British engineers are to spend a week in Canada, where as guests of the Institute they will visit several cities from Windsor to Quebec.

The Engineering Institute will hold a reception on Friday, September 5th from 5 to 7 p.m. at the Conrad Hilton Hotel (formerly the Stevens). To this will be invited all members of the Institute attending the meeting, the officers of several sister American societies, the officers of the South American societies who attended the UPADI Conference in New Orleans, the officers of the European societies and in particular the officers of the three British Institutions.

Members are urged to keep in mind that the reception is an invitation affair. It is essential that Headquarters know in advance which members expect to be there. The president, certain past presidents and other Institute officers will be there to receive the guests. The American Society of Civil Engineers has set this period of time apart so there will be no conflicting events. That evening A.S.C.E. is holding a smoker in the same hotel.

Institute members are welcome to attend the technical meetings of other societies, and where space permits, the social events as well.

Registration of Institute members will be at the Conrad Hilton Hotel but it is suggested that registration made in advance to Headquarters will facilitate matters greatly.

A block of rooms has been reserved by the Institute at the Conrad Hilton Hotel. Members are asked to make their reservations direct with the hotel, and to do it early as only a limited number of rooms are available.

The Centennial will be a great occasion. Its like may never be seen again. Canadians who wish to do honour to this great American society and to see and hear the story of "progress through engineering" should not miss this "world's fair of engineering".

The Institute is proud to have been invited to participate, and is pleased to make available to its members the myriad attractions that make up the mammoth program. It is hoped and expected that many Canadians will be there to join with the officers of the Institute in a salute to a great society and a good friend, the American Society of Civil Engineers.

The meetings which may interest you will be found listed on the opposite page.

Show Pieces

There is quite a program of non technical events which should be of considerable interest to the visitor. High on the list will be a musical presentation titled "Adam to Atom." This extravaganza will portray dramatically mankind's advance through the utilization of engineering and scientific achievements. There will be over 300 character roles in 27 scenes. The story starts in the days of the caveman and as the title indicates finishes at the present moment (or maybe later.)

"Adam to Atom" will be full hour and a half. There will be two shows daily with three on Saturdays and Sundays. It starts on July 12th and is shown in the main theatre of the Museum of Science and Industry. It will run right through the summer.

Another "show piece" will be the exhibition in the Museum of Science and Industry which will depict the 100 years progress in engineering development. This also will continue for several months.

Society	Location	T 2	W 3	T 4	F 5	S 6	S 7	M 8	T 9	W 10	T 11	F 12	S 13
American Concrete Institute	Conrad Hilton								X	X	X	X	
American Institute of Chemical Engineering	Palmer House									X	X	X	X
American Institue of Consulting Engineers	University Club							X					
American Institute of Electrical Engineers	Congress									X	X	X	
American Institute of Mining and Metallurgical Engineers	Palmer House		X	X	X	X	X						
American Iron and Steel Institute	Palmer House										X		
American Society for Engineering Education	W.S.E. Sheraton		X	X	X	X							
American Society of Agriculture Engineers	LaSalle							X	X				
American Society of Civil Engineers	Conrad Hilton LaSalle (3-4)		X	X	X	X	X	X	X	X	X	X	X
American Society of Lubrication Engineers	Sherman							X	X				
American Society of Mechanical Engineers	Sheraton							X	X	X	X		
American Society for Testing Materials	Sherman									X	X		
American Society of Tool Engineers	Furniture Mart									X			
American Standards Association	Museum of Science & Industry							X	X	X			
Association of Consulting Managing Engineers	Sheraton				X								
Engineers Council for Professional Development	Sheraton				X	X							
Engineering Institute of Canada	Conrad Hilton				X								
Illuminating Engineering Society	Edgewater Beach							X	X	X	X	X	
Industrial Management Society											X		
Institute of Radio Engineers												X	
Institute of Traffic Engineers	Sherman							X	X	X	X		
International Commission on Irrigation and Drainage	Conrad Hilton							X					
International Commission on Large Dams	Conrad Hilton				X								
Society for Advancement of Management	Illinois Institute of Technology										X	X	
Society of Automotive Engineers	Knickerbocker			X									
Society of Naval Architects and Marine Engineers	Sherman				X								
World Power Conference	Drake			X									

Canadian Main Line Connections to the Centennial of Engineering

Going (daily)	C.N.R.	C.P.R.
Lv. Montreal	3.30 P.M. E.S.T.	3.30 P.M. E.S.T.
Lv. Toronto	10.00 P.M. E.S.T.	10.00 P.M. E.S.T.
Ar. Chicago (change Toronto)	9.00 A.M. E.S.T.	9.10 A.M. E.S.T.
Returning (daily)		
Lv. Chicago	9.00 P.M. E.S.T.	8.35 P.M. E.S.T.
Lv. Toronto	9.15 A.M. E.S.T.	9.15 A.M. E.S.T.
Ar. Montreal (change Toronto)	4.10 P.M. E.S.T.	4.10 P.M. E.S.T.

Rail, sleeping and parlor car fares are as follows:

First class return, Montreal to Chicago	$65.75
First class return, Toronto to Chicago	$41.85
Parlor car seat, Montreal–Toronto, one way	$ 2.10
Lower berth, Toronto–Chicago, one way	$ 5.80
Roomette, Toronto–Chicago, one way	$ 6.40, $8.20

For further information contact your local passenger agent.

Elections and Transfers

At the meeting of Council held at Headquarters on Thursday, June 26th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

C. H. Abray, *Watertown.*
R. J. Anderson, *Toronto.*
L. A. Archambault, *Magog.*
J. T. Baran, *Montreal.*
J. Barcza, *Montreal.*
W. H. Berry, *Trinidad.*
K. W. Boldt, *Montreal.*
J. H. Bolton, *Montreal.*
W. H. Bonus, *Toronto.*
R. J. Brown, *Montreal.*
F. W. Bruce, *London, Eng.*
R. Comsa, *Montreal.*
C. L. F. Cooper, *Hamilton.*
J. P. Davies, *Montreal.*
G. A. Dawson, *Vancouver.*
F. L. Doty, *Saint John.*
J. H. E. Doyle, *Winnipeg.*
E. G. Faludi, *Toronto.*
J. K. Feldmark, *Montreal.*
C. E. Forest, *Montreal.*
R. T. Gerrard, *Montreal.*
R. H. Hall, *Montreal.*
B. G. Harvey, *Dawson, Y.T.*
F. K. Henning, *Montreal.*
A. Jaworski, *Ottawa.*
J. Kaller, *Vancouver.*
J. O. A. Lake, *London, Eng.*
H. H. Langshur, *Montreal.*
A. E. Lea, *Montreal.*
W. F. Lever, *Quebec.*
R. S. Libby, *Montreal.*
K. Linde, *Cornerbrook.*
N. D. Lindsay, *Toronto.*
G. F. Lloyd, *Montreal.*
J. A. MacLean, *Hamilton.*
D. A. MacLulich, *Ottawa.*
A. J. McIntyre, *Winnipeg.*
E. E. McLaughlin, *Toronto.*
W. H. McPherson, *Toronto.*
J. H. Marica, *Toronto.*
C. B. Martin, *Toronto.*
W. Merlin, *Montreal.*
S. Mikelsons, *St. John's.*
A. R. Mills, *Montreal.*
F. G. Murphy, *Toronto.*
M. Norvid-Neugesbauer, *Toronto.*
J. Parkinson, *Toronto.*
S. A. Perrot, *Toronto.*
R. W. Pike, *St. John's.*
W. J. Poyner, *Cardinal.*
K. Provost, *St. John's.*
J. H. Read, *Vancouver.*
R. K. Robertson, *Montreal.*
M. D. E. Robinson, *Vancouver.*
V. R. Saulite, *St. John's.*
S. W. Schortinghuis, *Winnipeg.*
M. Schuller, *Valleyfield.*
J. W. Seymour, *Toronto.*
R. A. Shier, *Belleville.*
B. S. Sigurdson, *Winnipeg.*
W. G. Small, *Trail.*
H. F. Stearns, *Ft. Erie.*
C. R. Stones, *Montreal.*
H. L. Streibel, *Montreal.*
J. A. Stoneman, *St. John's.*
E. H. Tedford, *Montreal.*
J. A. Thomas, *Montreal.*
J. J. Utikal, *Montreal.*
L. Watts, *Windsor.*
F. J. R. Webber, *Montreal.*
W. A. Wyszkowski, *Toronto.*
J. G. Ziverts, *Montreal.*

Juniors:

R. G. Bodie, *Beauharnois.*
I. M. Campbell, *Kamloops.*
W. H. Correll, *Windsor.*
G. D. Day, *Temiskaming.*
W. M. Flanagan, *Toronto.*
J. Gieysztor, *Montreal.*
L. G. Jamiseon, *Arvida.*
H. F. Klassen, *Sarnia.*
G. Kapolnai, *Montreal.*
J. Relich, *Caledonia.*
J. T. Rodd, *Montreal.*
F. A. Ross, *Montreal.*
W. J. Seal, *Windsor.*
P. Stamatopoulos, *Montreal.*
W. E. van Steenburgh, *Peterboro.*

Affiliate:

C. H. Stein, *Sarnia.*

Transferred from the class of Junior to that of Member:

J. R. Dalrymple, *Montreal.*
J. S. Francis, *Montreal.*
E. G. A. Jorgensen, *Hamilton.*
E. T. Kirkpatrick, *Edmonton.*
H. T. Lingham, *Montreal.*
J. H. Macdonald, *Winnipeg.*
J. R. Moran, *Victoria.*
L. R. Munroe, *Vancouver.*
J. V. Parr, *Windsor.*
H. T. Work, *Winnipeg.*

Transferred from the class of Student to that of Member:

P. A. Monaghan, *Toronto.*

Transferred from the class of Student to that of Junior:

J. M. Childs, *Cornerbrook.*
F. De Francis, *Montreal.*
J. R. Gregory, *St. Catharines.*

The following Students were admitted:

S. E. Atkinson, *Toronto.*
B. Cohen, *Winnipeg.*
G. Dineen, *Ottawa.*
C. F. Edgecombe, *Fredericton.*
R. J. W. Edwards, *Midland.*
G. M. Farantatos, *Toronto.*
J. M. Hall, *Saskatoon.*
M. A. Harrison, *Toronto.*
N. Huculak, *Edmonton.*
A. M. Ibrahim, *Edmonton.*
E. J. Jensen, *Kildonan.*
E. J. P. Klein, *Winnipeg.*
J. Lawrence, *Toronto.*
V. S. Lewis, *Arvida.*
A. J. Lillico, *Ottawa.*
S. Mollo-Christensen, *Delson, Que.*
D. J. Monaghan, *Sarnia.*
S. Narvey, *Raleigh, N.C.*
L. R. Nash, *Toronto.*
R. E. Power, *Fredericton.*
A. D. Scharf, *Saskatoon.*
R. J. F. Sherk, *Toronto.*
D. R. Stevenson, *Toronto.*
E. L. Sutherland, *Toronto.*
J. R. Wallace, *Edmonton.*

Applications Through Associations

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

ALBERTA

Members:

C. W. Bildstein.
J. P. Collier.
I. H. Fowler.
C. W. D. Milner.
W. H. Rolston.
E. W. Wheatley.

Junior to Member:

W. H. Garland.

SASKATCHEWAN

Members:

A. J. Altrogge.
S. D. Cavers.
R. L. Cockerell.
J. M. Snelgrove.
P. P. Trebuss.
H. Zasibida.

Students:

D. A. Bailey.
F. W. Catterall.
D. O. Coghlan.
B. C. Doell.
R. B. Gibson.
M. R. Gunderson.
S. E. Johnson.
J. H. Kearney.
A. Kobelak.
J. J. Schmidt.
D. I. Tilden.
F. J. Vick.

Junior to Member:

R. G. Brown.
E. Y. Carlson.
H. P. Gatin.
W. J. Hardstaff.
S. Kotyk.
K. N. Lamb.
L. H. Ritenburg.
N. G. Tribe.

Student to Junior:

T. J. Robertson.

NEW BRUNSWICK

Junior to Member:

L. A. Dawson.
P. W. Hastings.
K. R. Thompson.

NOVA SCOTIA

Junior to Member:

V. A. Campbell.
D. A. Eisenhauer.
B. J. Hamm.
D. J. MacQuarrie.

QUEBEC

Member:

R. B. Winsor.

Junior:

A. Woinowsky-Krieger.

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Addresses Wanted

In order that our membership records may be as complete as possible, it would be greatly appreciated if any available information regarding the whereabouts of the following members could be sent to us with the least possible delay.

Members

Archibald, George Hughes
Barratt, Ernest F.
Beatty, James Edward
Boisclair, Robert
Boismenu, Romeo
Bowie, Ralph Allen
Brown, Alexander
Brown, Hugh Carey
Clark, Alvin Ira
Davison, Charles Fraser
Docken, Gordon C.
Donnelly, John
Ewart, George R.
Fowler, Charles E.
Fraser, Duncan Nycander
Gates, Fred Ruttan
Gordon, John
Grey, Noel Wm.
Gumley, F. Stewart
Hahn, Herman Gustav
Hunter, Henry G.
Hutton, John Robt.
Laidlaw, Douglas Staunton
Lewicki, Wladimir Peter
MacCulloch, Willard Fraser
Macgillivray, Andrew
MacNeil, Reginald J.
Miron, Jacques
Mock, William
Moffatt, Edward Hopkins
Nesham, Lional Charles
Olynyk, Peter John
Phillips, George L.
Russell, Harold George
Sadler, Robert Francis
Shatford, Ralph Grant
Snyder, Reinhold Roy
Steenbuch, Harald L.
Sucharov, Bert
Sutherland, J. R. S.
Tendeck, Peter Nick
Venart, Chas. Herbert Somerville
Wallis, Wm. Herbert Cyril

Juniors

Adey, Albert Wesley
Adrian, Walter Hilmer
Alberts, Russell Sarino
Amundrud, George Leonard
Anderson, Errol T. H.
Ansley, Harry Edward
Armstrong, Wilfred Hugh
Baker, Frederic Bruce
Baker, James Rufus
Ball, Robert Spencer
Bamford, Alfred Basil
Baragar, Harold Albert
Barber, Norman Lyall
Barnes, Lemuel George
Bateman, John Lincoln
Beaugrand, Raymond
Beland, Jacques
Belanger, Joseph Jean Yves
Bennet, John Michael
Bennett, William David
Bennetts, Ronald Stanley
Beverly, William McGregor
Blais, Roger
Blakney, Hilbert Harris
Blauer, Aaron
Bouchard, Leo Joseph
Bourgon, Jean-Paul
Bousquet, Paul
Boyd, Archie Vhester
Brais, Paul Jean
Brewer, Donald Austin
Brock, Frank Morgan
Butler, James E.
Buzton, John Healy
Bzovey, Dmytro
Cameron, Byron Merle
Campbell, John Ansell
Carriere, Robert Leon
Caswell, Gerald Everett
Cates, Theodore Phillip
Caveen, Donald Fredrick
Chabot, Gilles
Charlton, Richard Jeffrey
Chisholm, William Stanley
Chizen, Martin
Chouinard, Roger J.
Churchill, Frederick Ezra
Clarkson, Vernon Medley
Cochrane, Thomas Stirton
Cohen, Haggai
Cohen, Horace Leonard
Collins, John Harris
Cooper, William Sydney
Couture, Louis-P.
Cox, John Robert Gordon
Coyman, Frank
Cunningham, Milton William
Dalton, John Terrence
Danaher, Brian
D'Auteuil, Leonard
Davidge, Owen Sydney
Davis, Gordon Allan
Davis, Harold Bruce
Daza, David
De Gast, Marcus Anthony
Deibert, Balzar Michael
DeRoo, Louis Alan
Derouin, Gerald Joseph
Desert, Lionel
Devlin, George Gribben
Dick, K. Thomas
Dickens, Harry Brian
Dodds-Hebron, Robert
Dolan, Gordon Ross
Dougherty, Miss Mary Ellen
Drolet, Paul
Dudley, Robert Stanley
Duerksen, John
Dunbar, Douglas Jean
Earle, John Sutherland
Erfle, Melvin Emil
Evans, William Ernest
Extence, Alan Barr
Fast, Bernard
Fawkes, Norman
Fenske, Lloyd David
Ferguson, Donald Joseph
Ferguson, Philip
Fitzgerald, John Gerry
Fisher, Foster Clarence
Fitz-Henry, Robert Woodfield
Flagg, David George
Flowers, Leonard Brian
Gauthier, Russel
Genge, Gordon Melville
Gerrior, Leo Joseph
Gibson, Philip Ernest
Gilbert, Edgar
Gillin, Mark Patrick
Gold, Lorne William
Goldman, Conrad
Goodman, Vernon James
Gordon, Ian Percy
Gourley, Ronald James
Gowsell, Robert William
Greig, Henry James
Griffiths, Peter Gordon
Harris, Charles Gordon
Harrison, Edgar Gordon
Hess, Lloyd Jerome
Heuft, William Ernest
Hierlihy, George
Higgins, Thomas Gerard
Hobsbawn, Peter Geoffrey Berkwood
Horie, Alfred Velson
Howell, Allison Brant
Ingram, Robert William
Jain, Purushottam Lal
James, Robert Enon
Jameson, Victor Karl
Jardine, George Sterling
Jarratt, William Ernest
Johnson, Erwin Dean
Johnson, James Edward
Johnson, Walter Lee
Johnston, Walter
Kearns, Keith William
Kernahan, George Martin
Kerns, James E.
Kerrigan, Geoffrey Moore
Kilgour, George Robert
Kilgour, John
King, Wilbur A.
Kjarsgaard, Robert John
Kupisz, Melvin Chester
Lackenbauer, Wilbert Francis
Lackman, Gerald Leonard
Laganiere, Gabriel
Lamothe, Andre Stanhope
Lanneville, Roger
LaRochelle, Andre
Lawson, Gerald Blake
Lepine, Jerome
Lepp, Jacob Henry
Lewis, Robert Arthur
Lloyd, Kenneth Bertram
Long, Julius Michael
Lotts, Bruce Carl
Low, Donald Richard
Lynes, Douglas Bennett
McAllister, John Everett
McCarthy, Owen Terrence
MacDonald, Cecil Ernest
MacDonald, John Kenneth
McEwen, Morris Stanley
McEwen, William Duncan
MacFadden, Jack Hylton
MacGregor, W. Robert
McIntosh, Lawrie Gandier
McKellar, Arthur Donald
McKenzie, Eric John
McKillop, John Alexander
MacLoon, Frank Chubb
McMeekin, Robert Wilson
McPherson, Angus Alexander
McPherson, George Anderson
Maidment, Howard
Mann, Ian Darney
Marcotte, Wilfred C.
Marner, Robert James
Martin, John
Messenger, Ivyl
Miall, Edward
Michaud, Pierre
Mill, John McIntosh
Millar, Norman Ralph
Mills, John Franklin
Montegani, Anthony Louis
Montgomery, Walter Louis
Moore, Ralph Mitchison
Morgan, George Walter
Morgulis, Isaac Allan
Mowchebko, Alexander
Munson, John Frederick
Neron, Majoric
Netterfield, William Maxwell
Nicol, Campbell Murdo
Northrup, Russell Grant
Nunes, Ferdinand
Nuttall, George Edward
O'Shea, Stanislaus Sullivan

Palsson, Petur
Patry, Marcel
Perrier, Joseph Francis
Ploen, Willy
Poirier, Joseph Pierre Arthur
Pollack, Morris Reuben
Pollard, James Keith
Pollock, Lorne Boyd
Prediger, Peter John
Pukalo, Walter

Raby, John Ronald
Randall, Jack Bernard
Reesor, Thomas Richard
Richardson, Robert Thompson
Riches, William Murray
Richmond, James William
Roberts, Art Bruce
Robichaud, Fernand
Robinson, Alfred
Robinson, Cyril
Robinson, James Allen Law
Roslyn, Stanley
Ross-Ross, Philip Arthur
Rousseau, Louis
Rudnick, Norman

Sainsbury, Lawrence Alten
Sanders, George Saunton
Saunders, Robert Gerald
Scarabelli, Rudolph John
Schurman, Peter
Schut, Stanley Sierag
Selby, Joseph John
Seto, Alford
Shnay, Robert Charles
Silver, Saul
Simpson, Leslie Charles
Smith, George Avery
Smith, Harry Douglas
Soderlund, Harold Werner
Spencer, Robert Arthur
Spoov, Nicholas Andrew
Spring, Maurice Arthur
Steed, Oliver Max
Stroud, Earl Louis
Swim, Robert Francis
Syme, Andrew Macalister

Tanel, Fikret Azmi
Termuende, John Edward
Tessier, Robert
Thaler, John David
Thibault, Lucien Charles
Thorson, Emil

Urban, Charles John
Urquhart, Robert Donald

Valere, Eric Arthur
Van Camp, Harold
Varley, Norman
Veres, John

Wake, Keith Parker
Waldron, John Westbrook
Wales, Donn
Walker, Bruce George
Walrath, Charles Alvin
Ward, Norris Bartley
Warwaruk, Russell John
Welch, Warren Taylor
Westman, Robert Allan
Whitehead, John Paul
Willett, Lawrence St. Clair
Windeler, Gavin Clark
Wright, James Peter

Maritime Professional Meeting

of

THE ENGINEERING INSTITUTE OF CANADA *and* THE ASSOCIATIONS OF PROFESSIONAL ENGINEERS *of* NEW BRUNSWICK AND NOVA SCOTIA

•

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September 10, 11 and 12, 1952

Professional sessions, technical papers, regional meeting of Institute Council, luncheons and banquet, dance, sports and recreation.

Further details will be published in the August *Journal*

News of Other Societies

The **American Institute of Chemical Engineers** (120 East 41st St., New York 17, N.Y.) has scheduled meetings as follows: Sept. 11-13, 1952, at Palmer House, Chicago, Ill.; and the annual meeting at the Hotel Cleveland, and Carter Hotel, Cleveland, Ohio, December 7-10, 1952.

The fall meeting of the **American Institute of Mining and Metallurgical Engineers** (29 West 39th St., New York 18, N.Y.) is scheduled for September 3-6, at Palmer House, Chicago, Illinois.

The 20th National Exposition of Power and Mechanical Engineering will be held in Grand Central Palace, New York, December 1 to 6, 1952. It is again under the auspices of the **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) whose annual meeting will be in session during the same week at the Statler Hotel, New York.

Also scheduled are other meetings, as follows: Sept. 8-11, 1952, A.S.M.E. fall meeting, Sheraton Hotel, Chicago, Ill.; Sept. 8-12, 1952, A.S.M.E. industrial instruments and regulators division, and Instrument Society of America, exhibit and joint conference, at Cleveland, Ohio; Sept. 22-24, 1952, A.S.M.E. petroleum mechanical engineering conference, Hotel President, Kansas City, Mo.

The fourth congress of the **International Association for Bridge and Structural Engineering** will take place at Cambridge and London, England, August 25 to September 1, 1952.

The twenty-first international congress for housing and town planning, will take place at the Technical University, Lisbon, Portugal, September 21-27, 1952.

Information can be obtained from the headquarters of the International Confederation for Housing and Town Planning, Bezuidenhoutseweg 75, The Hague, Netherlands.

The World Power Conference, 1952, will take place in Chicago, Ill., September 3 to 15.

Personals

News of the Personal Activities of Members of the Institute

W. F. Miller, M.E.I.C., district inspector for the Department of Trade and Commerce at Sudbury, Ont., has been elected to serve as chairman of the Sudbury Branch of the Institute.

Born and educated at North Bay, Ont., Mr. Miller graduated in electrical engineering from Queen's University in 1932. He then worked in the Municipal Power Engineering Department of the Hydro-Electric Power Commission of Ontario where his duties covered construction, design and operation of rural electric distribution systems. In 1935 he became inspector of electricity and gas with the Department of Trade and Commerce at Sudbury.

G. L. Hood, M.E.I.C., of the Hydro-Electric Power Commission of Ontario has been elected to serve as Chairman of the North Bay, Temiskaming Branch of the Institute.

Mr. Hood was born at Minnedosa, Manitoba, educated at Oxbow, Saskatchewan and graduated in electrical engineering from the University of Manitoba in 1932. In 1934, he started work on electrical maintenance with the Howey Gold Mine. He was a demonstrator during 1937-38 at the University of Toronto and was for a short time a draughtsman with the Toronto Harbour Commission.

He joined the Hydro-Electric Power Commission of Ontario in 1938 as assistant meter and relay engineer at North Bay, Ontario. Later he was stationed at Port Arthur and at Timmins, Ontario. In 1949 he was transferred to North Bay as superintendent of meters, relays and communications for the North Eastern region of the Hydro-Electric Power Commission.

I. M. Foster, M.E.I.C., chief designer of Spruce Falls Power and Paper Company, Limited, at Kapuskasing, Ont., has been elected to serve as chairman of the North Eastern Ontario Branch of the Institute.

Born in Somerset, England, Mr. Foster was educated at Public and High Schools in Montreal and graduated in mechanical engineering from McGill University in 1937. He worked with the Brown Corporation at La Tuque, Que. until 1943 when he served with the R.C.E.M.E. in Canada and overseas. In 1946 he joined the Laurentide Division of the Consolidated Paper Corporation at Grand'mere, Que. as chief draughtsman, going to Kapuskasing in 1947.

G. A. Bradford, M.E.I.C., plant engineer of the Bakelite Company of Canada, at Belleville, Ont., has been elected to serve as chairman of the Belleville Branch of the Institute.

Mr. Bradford was born at Brockville, Ont., and educated at the Public School and Collegiate at Saskatoon, Saskatchewan. In 1932 he graduated in mechanical engineering from the University of Saskatchewan and the following year joined Imperial Oil Limited at Sarnia, Ont., as designing draughtsman, becoming development engineer in 1938. In 1941 he worked with the Welland Chemical Works at Niagara Falls, Ont. and later joined H. G. Acres and Company at Niagara Falls, Ont.

He was in the Bakelite and Plastics Division of Carbide and Carbon Chemicals Limited at Toronto, before becoming plant engineer with the Bakelite Company of Canada in 1947.

T. R. McLagan, O.B.E., M.E.I.C., president of the Canada Steamship Lines Limited, has been named a member of the Board of Governors of McGill University.

Mr. McLagan is also a director of the Electric Boat Company of New York and its Canadian subsidiary, Canadair Limited, Abitibi Power and Paper Company, Montreal Dry Docks Limited, and Commercial Alcohols. He is a president of the Canadian Shipbuilding and Ship Repairing Association and for a number of years was vice-president and general manager of Canadian Vickers Limited, Montreal.

Dr. T. H. Hogg, M.E.I.C., was recently elected to the board of directors of the Viceroy Manufacturing Company Limited. Dr. Hogg is a prominent consulting engineer and serves on the boards of several leading Canadian companies. He is a member of the Senate of the University of Toronto, and is a former chairman of the Ontario Hydro-Electric Power Commission, and a past president of the Engineering Institute.

Dr. J. J. O'Neill, M.E.I.C., has retired as dean of the engineering faculty, and Dawson professor of geology and chairman of the department of geology of McGill University. He will continue his work as vice-principal of McGill until Principal James returns from Europe at the end of the summer.

Recently he was awarded the honorary degree of doctor of science by McGill as a tribute to a life of service to the university from which he graduated 43 years ago with a B.Sc. degree in mining engineering. He received an M.Sc degree in geology a year later. He continued work in geology at Yale University, receiving the degree of Ph.D. in 1912. For four years he was connected with the Geological Survey of Canada and from 1913 to 1916 he was a geologist with the Canadian Arctic Expedition. From 1920 to 1921 he was engaged in geological work in British India and Kashmir. Returning to Canada he joined the staff of McGill as a lecturer in 1921 and received subsequent appointments, as follows: assistant professor in 1924, associate professor in 1927, Dawson professor of geology and head of the department of geological sciences in 1929, dean of the science division in 1935, dean of the

Dr. J. J. O'Neill, M.E.I.C.

faculty of graduate studies in 1939, and dean of the faculty of engineering in 1942.

Dr. O'Neill was elected president of the Royal Society of Canada in 1950. He is a member of the Professional Engineers of Quebec, the Canadian Institute of Mining and Metallurgy, the Geological Society of America, the American Institute of Mining, the Society of Economic Geologists, the Canadian Association of Geologists. He was elected chairman of the Arctic Institute of North America in 1949.

H. W. Tate, M.E.I.C., assistant general manager of the Toronto Transportation Commission, has been elected president of the Canadian Transit Association.

Mr. Tate has been with the Toronto Transportation Commission since his graduation from the University of Toronto in 1910. From 1915 to 1919 he served with the armed forces in the First World War, attaining the rank of major and being twice mentioned in dispatches. In 1927 he was appointed assistant manager with the Commission.

Charles Scrymgeour, M.E.I.C., has been transferred by the Imperial Oil Limited from the Ioco Refinery in British Columbia to the Montreal Refinery where he will take the position of general superintendent.

Mr. Scrymgeour has been with the Imperial Oil Limited since 1921; he became refinery engineer in 1929 and was appointed assistant superintendent in 1939. For a time during the war he was acting superintendent at the Halifax Refinery. He came to the Montreal Refinery in 1946 as superintendent, transferring to British Columbia in 1948 as superintendent of the Ioco Refinery.

Before joining the Imperial Oil Limited, he served his apprenticeship with James Buchanan and Sons Limited at Liverpool, England, where he was also born and educated.

He came to Canada in 1919 to join the Acadia Sugar Refinery Company Limited at Woodside, Nova Scotia. Mr. Scrymgeour is a past chairman of the Halifax Branch of the Institute and a past-councillor of the Institute.

Norman Marr, M.E.I.C., former chief of the water resources division of the Department of Resources and Development has been appointed director of the engineering and water resources branch.

Mr. Marr is a native of Walkerton, Ontario; he received his primary education there and his secondary education in London, Ontario. In 1912, he graduated in civil engineering from the University of Toronto with the degree of Bachelor of Applied Science, and in 1922, he received the degree of civil engineering from the same university.

Following early engineering work on land surveys, railway location and construction, and canal construction, Mr. Marr joined the government service and for the past 34 years has served with what is now the water resources division of the Department of Resources and Development.

Mr. Marr was chairman of the Canadian section of six international engineering boards appointed by the International Joint Commission in connection with matters under reference to the Commission. He also represented Canada on six international boards of control concerning waterway matters already dealt with by the International Joint Commission.

He is a member of the Prairie Provinces Water Board, and a member and honorary secretary of the Canadian Committee of the World Power Conference, and has been recently appointed a member of the board of engineers concerned with the St. Lawrence seaway.

Mr. Marr has served as chairman of the Ottawa branch of the Institute and as a member of Council. He is also a member of the Professional Institute of the Public Service.

A. G. Farquharson, M.E.I.C., has been appointed vice-president (refining) with the McColl-Frontenac Oil Company Limited.

Mr. Farquharson graduated in metallurgical engineering from Queen's University in 1930 and joined McColl-Frontenac in 1931. In 1943 he was appointed assistant manager (refining) and became manager of the Refining Department in 1945, which position he held until his recent appointment.

A. G. Farquharson, M.E.I.C.

Bruce B. Shier, M.E.I.C., manager of the general service division of Automatic Electric (Canada) Limited, Toronto,

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Bruce Shier, M.E.I.C.

has been appointed advertising and sales promotion manager of that firm.

Mr. Shier graduated from McGill University with the degree of Bachelor of Science in electrical engineering in 1923. He spent several years in the inspection engineering department of the Northern Electrical Company Limited in Montreal of field surveys of automatic telephone equipment and statistical quality control studies. In 1935 he joined the staff of Automatic Electric (Canada) Limited as sales engineer for communication and electrical control equipment in their Montreal office. Two years later he was transferred to their head office in Toronto. Since 1947 he has been in charge of sales promotion of all products handled by the company, which responsibility he will continue in his new capacity.

Dr. W. C. Howells, M.E.I.C., formerly of the Texaco Exploration Company, is now with Anglo-American Exploration Limited, as manager of exploration and development, at Calgary, Alberta.

Dr. Howells is a graduate of the University of Alberta, where he received a B.Sc. degree in 1932. He received a M.Sc. degree in geology in 1934 and the degree of Ph.D. in geology from McGill University in 1939.

Before joining the Texaco Exploration Company as chief landman, Dr. Howells was the district geologist for McColl-Frontenac Oil Company at Calgary, Alberta.

A. T. Hurter, M.E.I.C., of Stadler, Hurter and Company, consulting engineers of Montreal, Que., has recently returned to this country after visiting Finland, Sweden, Norway, Denmark, Germany, Switzerland and France.

In Finland, Mr. Hurter inspected a number of pulp and paper mills in order to check the progress of work on various projects for which Stadler, Hurter and Company prepared the design data, plans and specifications in their offices in Montreal. The company is at present working on four contracts with Finnish pulp and paper mills; and three Finnish newsprint projects are planned. In Switzerland, one Swiss pulp and paper mill has engaged the services of Stadler, Hurter and Company for their improvement program. Swedish mills and German pulp and paper machinery construction activities were found to be active.

S. E. Flook, M.E.I.C., city engineer of Port Arthur, Ont., has retired after 17 years service and is returning to the occupation of land surveyor and consulting engineer.

S. E. Flook, M.E.I.C.

Mr. Flook was born at Willowdale, Ont., and attended the University of Toronto, where he obtained a B.A.Sc. degree in civil engineering in 1912; the following year he was apprenticed with an Ontario land surveyor and obtained his O.L.S. in 1913. His company then sent him to survey the Duck Lake area and a short time later he set up a private surveying business. In 1916 he became associated with C. D. Howe and Company, consulting engineers, on grain terminal design and construction and continued as a part-time employee until 1929.

After 1930, he was elected for three terms on city council; he resigned in 1935 following his appointment as city engineer of Port Arthur, which position he held until his retirement.

Mr. Flook is a past chairman of the Lakehead Branch of the Institute and in 1951 was elected councillor to represent the Lakehead Branch.

F. C. Graham, M.E.I.C., has been appointed city engineer at Port Arthur, Ont., succeeding S. E. Flook, M.E.I.C.

Mr. Graham joined the city engineering department at Port Arthur as a chainman in 1908 and became assistant city engineer in 1923.

He is a past chairman of the Lakehead Branch of the Institute.

F. C. Graham, M.E.I.C.

A. B. Hunt, M.E.I.C., manager of the communications equipment division of the Northern Electric Company Limited, has been elected president of the Radio-television Manufacturers Association of Canada.

Mr. Hunt graduated from the University of Toronto with a B.A.Sc. degree in 1928 when he was awarded a medal from

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the British Association for the advancement of Science. He joined the Northern Electric Company Limited after graduation and has been actively associated with radio communications ever since.

A. L. Spackman, M.E.I.C., has joined the Canadian Aeronautical Radio at Dorval Airport, Montreal, Quebec, as general manager.

Previously he was with Cossor (Canada) Limited at Halifax, Nova Scotia.

D. Temple, M.E.I.C., has been appointed resident engineer for the Defence Industries (1951) Limited on the project for the rehabilitation of the de Salaberry Works.

Mr. Temple was previously assistant resident engineer for the Defence Industries Limited at Montreal, and at Valleyfield, Que. Earlier, he was superintendent on inspection and general services for the National Research Council Atomic Energy Project at Chalk River, Ontario.

W. A. Friebel, M.E.I.C., electrical engineer for Saskatoon, Saskatchewan, has been appointed city engineer to succeed **H. McIvor Weir,** M.E.I.C., who will retire at the end of this year.

Mr. Friebel graduated in electrical engineering from the University of Manitoba in 1933. After two years, he joined the Saskatchewan Power Commission in 1936 as district operator. He was appointed line superintendent for the Saskatoon district in 1940, and in 1946 joined the city engineering department at Saskatoon. The following year he was appointed assistant electrical engineer and in 1950 he succeeded to the position of city electrical engineer.

Mr. Weir, who will be retiring at the end of this year from his position as city engineer of Saskatoon, went to Saskatoon in 1911 after a varied and well-travelled career. He has been with the engineering department ever since He was appointed city engineer in 1947 after several years as assistant engineer.

Previously, he had worked in Northern British Columbia, Nova Scotia, Cleveland, Ohio, and Mexico.

Douglas Norman, M.E.I.C., is manager of engineering standards with the Canadian General Electric Company at Peterborough, Ont. Previously he was manager of distribution at Toronto, Ont.

Mr. Norman joined the Canadian General Electric Company soon after his graduation from the University of Manitoba in 1926.

J. M. Patterson, M.E.I.C., is with the Permanent Timber Products Limited at Vancouver, B.C.

Mr. Patterson graduated from the University of Saskatchewan in civil engineering in 1948 and worked as a bridge engineer with the Department of Highways of Saskatchewan.

In 1951, he was with the British Columbia International Engineering Company at Vancouver, B.C.

E. H. Henderson, M.E.I.C., has joined Kearns and Bromley, consulting engineers, at Sackville, N.B. He had previously been with the Keith Brokerage (engineering equipment) at Sackville.

Mr. Henderson spent some years with the Halifax Shipyards Limited, in Nova Scotia and for a time was maritime distributor for Plibrico Jointless Firebrick Company of New Toronto, Ontario and Maritime representative for E. F. Drew and Company Limited.

In 1949 he became manager of the Plibrico Sales and Service Company.

Major E. C. Ilott, M.E.I.C., of the R.C.E.M.E. is in Ottawa, Ont.

In 1950 Major Ilott took the technical staff officers course at the Military College of Science at Shrivenham, in Wiltshire, England.

He graduated with a B.Sc. degree from London University in 1941.

He was a captain and instructor at the R.C.E.M.E. school at Barriefield, Ont. in 1948 before going to England.

J. H. Ings, M.E.I.C., has been appointed assistant chief engineer of H. G. Acres and Company at Niagara Falls, Ont. He had previously been a hydraulic engineer with the company.

Mr. Ings joined the Company some six years ago after working in Ontario for the Spruce Falls Power and Paper Co., and the Gatineau Power Company; and in Quebec for the Beauharnois Construction Company. He graduated in civil engineering from University of Toronto in 1925, and received the degree of C.E. from the University in 1931.

C. B. McMillan, M.E.I.C., has joined Surveyer, Nenniger and Chenevert, Montreal.

After graduating in civil engineering from Queen's University in 1936, Mr. McMillan went with the Ontario Paper Company at Baie Comeau, Que., and the following year he joined the staff of the Aluminum Company of Canada.

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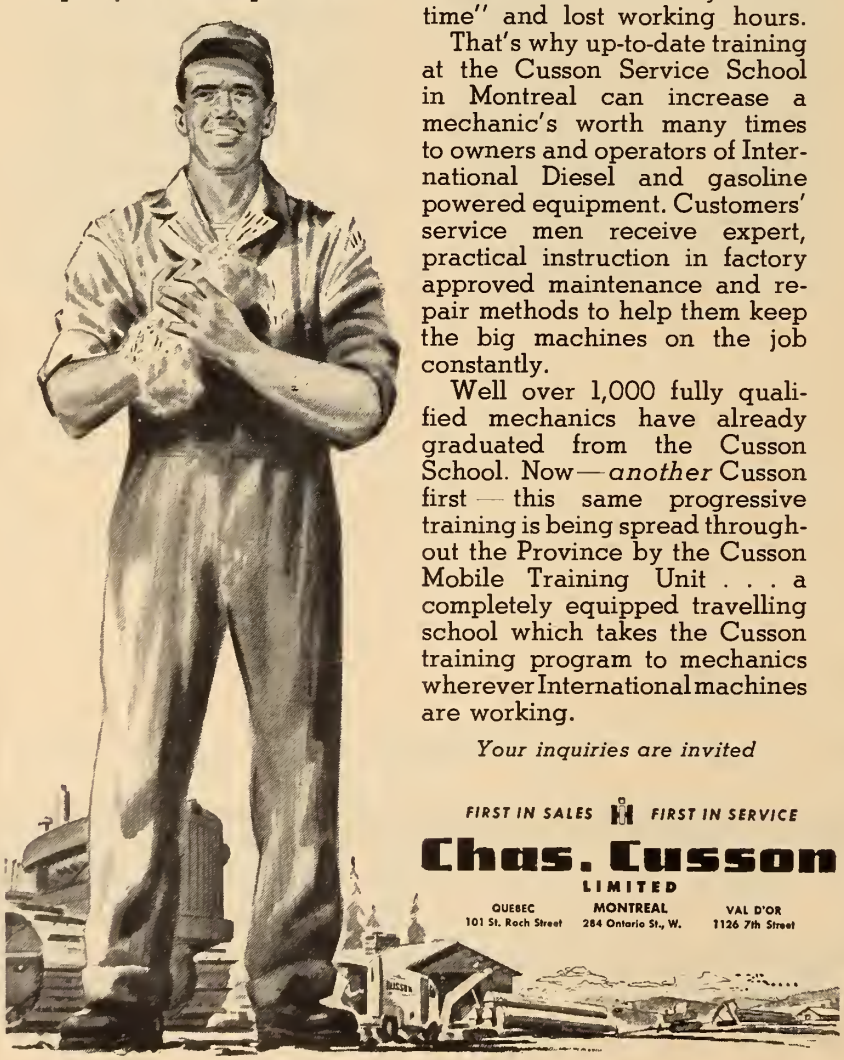

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Limited, as a junior engineer at Arvida, Que. In 1938, he was transferred to the staff of the Saguenay Power Company at Arvida and remained in that position until the end of 1940 when he joined the Canadian National Railway Company at Montreal. Later he served with the R.C.A.F., returning to the C.N.R. in 1946.

In 1948 he took the position of assistant engineer with C. Davis Goodman, architect, at Ottawa, Ont., becoming chief engineer in 1949.

D. H. Rochester, M.E.I.C., has been awarded the O.B.E. for service in Korea.

Lieutenant-Colonel Rochester recently joined the Canadian Army Staff College at Kingston, Ontario, and is on the directing staff of the college.

R. A. Portsmouth, M.E.I.C., is with the Lago Oil and Transport Company Limited at Aruba, Neth. W.I.

Previously, he was a refinery engineer with the Husky Oil and Refining Limited, at Lloydminster, Saskatchewan.

W. D. Puziak, M.E.I.C., has left Stone and Webster, Froomfield, Ont., to join Catalytic Construction of Canada Limited at Sarnia, Ontario, as chief field engineer.

Mr. Puziak graduated in civil engineering from the Technical University of Lwow, Poland, in 1939.

H. V. E. Rosenthal, M.E.I.C., has joined Canadian Allis-Chalmers Limited at Lachine, Que.

Previously he was working as a designing draughtsman with Dominion Engineering Works Limited at Montreal, Que.

Mr. Rosenthal graduated in mechanical engineering from the Institute of Technology at Darmstadt, Germany, in 1937.

Captain Jack Adams, M.E.I.C., is stationed at the R.C.E.M.E. School at Barriefield, Ontario. He was previously a project engineer at the Canadian Joint Air Training Centre at Rivers, Manitoba.

A. R. Babbitt, M.E.I.C., is resident engineer with the Department of Highways at Fredericton, N.B. He had previously been working as construction engineer for the Department which he joined some 20 years ago to work on the St. Johns harbour reconstruction.

R. F. P. Bowman, M.E.I.C., has been transferred by the Canadian Pacific Railway Company from the post of assistant superintendent at Bassano, Alberta, in Medicine Hat, Alberta, as assistant superintendent.

Mr. Bowman graduated from the University of Manitoba in 1928 and joined the C.P.R. in 1931 as roadmaster at Aldersyde, Alberta, later moving to Lethbridge, Alta.

During the Second World War, Mr. Bowman served with the railway troops, R.C.E., overseas, during which time he was awarded the M.B.E. and attained the rank of major. On his return he went to Brandon, Man., for C.P.R.

G. R. Williams, Jr.E.I.C., has recently joined the Aluminum Company of Canada Limited at Shipshaw, Quebec.

Previously he was a structural engineer with G. L. Wallace at Toronto, Ont.

Mr. Williams graduated with a B.A.Sc. degree in civil engineering from the University of Toronto in 1948.

J. A. Morton, Jr.E.I.C., is an inspection engineer in the Montreal area for Canadian Industries Limited.

Mr. Morton graduated in mechanical engineering from McGill University in 1949.

D. M. Archer, Jr.E.I.C., is with Air Reduction Canada Limited at Montreal, Que. Previously he was a junior engineer with the Aluminium Company of Canada at Arvida, Que.

Mr. Archer graduated in metallurgical engineering from the University of Toronto in 1948.

M. C. Nadas, Jr.E.I.C., has recently joined the Corrosion Service Limited at Toronto, Ont. He has previously been a paint chemist with Scarfe and Company Limited at Brantford, Ont.

Mr. Nadas graduated with a B.A.Sc. degree in chemical engineering from the University of Toronto in 1950.

J. E. Pickering, Jr.E.I.C., has recently joined Canadian Industries Limited at Montreal, Que.

Previously he was working on maintenance, drafting and design with Price Brothers and Company Limited at Jonquiere, Quebec.

Mr. Pickering graduated in mechanical engineering from the University of Saskatchewan in 1946.

F. W. Brown, Jr.E.I.C., is in India with the Geophysical Prospecting Company Limited at Bombay. He had previously been with the Geo-Technical Development Company Limited at Bourlamaque, Que.

Erratum

A Personal about **Harvie D. Walford,** Jr.E.I.C., appearing in the May issue was incorrect.

Mr. Walford is with the Aluminum Company of Canada, and has been and still is, stationed at the Centre d'Etudes Industrielles at Geneva, Switzerland; a correct announcement of this appointment was made in the October issue of the *Journal,* 1951.

Misinterpretation of a recent forwarding address resulted in an incorrect statement being made in the May issue. An apology is offered by the *Journal* to Mr. Walford and to its readers.

Mr. Brown graduated with a B.A.Sc. degree in engineering physics from the University of Toronto in 1950.

D. M. Stewart, Jr.E.I.C., has joined the Schlumberger Well Surveying Corporation at Calgary, Alberta. He was previously with the Canadian Comstock Company at Seaforth, Ont.

Mr. Stewart graduated in electrical engineering from the University of Saskatchewan in 1949.

F. R. Carruthers, Jr.E.I.C., is a lieutenant in the R.C.E.M.E. at Kingston, Ontario. He graduated in electrical engineering from Queen's University in 1950.

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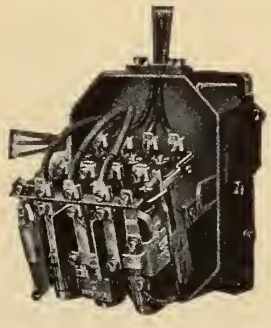

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J. S. Denis, JR.E.I.C., is working at the Celco Plant of the Celanese Corporation of America, in Narrows, Virginia, U.S.A.

Previously he was working with the International Nickel Company of Canada at Sudbury, Ontario.

Mr. Denis graduated in chemical engineering from the University of Alberta in 1949.

M. G. Bolstad, JR.E.I.C., has recently joined the engineering department of Canadian Refractories Limited at Marelan, Que. Previously, he was a ceramic engineer with the Gypsum Lime and Alabastine (Canada) Limited at Caledonia, Ont.

Mr. Bolstad graduated in ceramic engineering from the University of Saskatchewan in 1949.

E. W. Hayes, JR.E.I.C., is with Barnett and Rieder (Architects) at Kitchener, Ont. Previously he had been a civil engineer with H. G. Acres and Company at Niagara Falls, Ont.

Mr. Hayes graduated in civil engineering from Queen's University in 1949.

B. T. Kerr, JR.E.I.C., is vice-president with the Purdy and Henderson Company Limited at Montreal, Que. He was formerly managing director of this company.

Mr. Kerr graduated in civil engineering from the Nova Scotia Technical College in 1947 and then worked with the Shawinigan Engineering Company at Shawinigan Falls and at Laviollette, Quebec.

A. G. Lane, JR.E.I.C., has recently joined Canadian Car and Foundry Co. Ltd., Montreal, Que. He has been teaching at McGill University for five years.

Mr. Lane graduated in mechanical engineering from McGill University in 1947 and received a master's degree in 1950. Meanwhile he was a demonstrator and lecturer in mechanical engineering, and he was appointed assistant professor in mechanical engineering in 1951.

E. L. Mercer, JR.E.I.C., has joined Timber Structures of Canada Limited at Peterborough, Ont. He was previously a draughtsman with the Dominion Bridge Company at Toronto, Ont.

Mr. Mercer graduated with a B.A.Sc. degree in civil engineering from the University of Toronto in 1950.

A. S. Fairhead, JR.E.I.C., is with the International Harvester Company, at Hamilton, Ont. He had previously been with the Lake Simcoe Ice and Fuel at Toronto, Ont.

Mr. Fairhead graduated with a B.A.Sc. degree in mechanical engineering from the University of Toronto in 1948.

J. D. Goss, JR.E.I.C., is an assistant plant supervisor with Canada National Communications, at Moncton, N.B.

Previously he worked in the engineering department of Canadian National Telegraphs at Toronto, Ont.

Mr. Goss graduated in electrical engineering from the University of New Brunswick in 1949.

R. Guertin, JR.E.I.C., is a civil engineer with MacMillan and Bloedel Limited, Vancouver, B.C.

He had previously been a salesman with MacMillan and Bloedel Sales (Quebec) Limited. Mr. Guertin graduated in civil engineering from McGill University in 1951.

H. J. Kelsall, S.E.I.C. (University of British Columbia, 1952) is with the Department of Public Works at Rossland, B.C.

T. R. Kostiuk, S.E.C., is a resident engineer with the Department of Highways at Edmonton, Alberta.

Mr. Kostuik graduated in civil engineering from the University of Alberta in 1951.

J. B. Lucas, S.E.I.C., is a flying officer in the R.C.A.F. stationed at the Air Material Command headquarters, Victoria Island Division, at Ottawa, Ont.

Mr. Lucas graduated in civil engineering from the University of Manitoba in 1951 and was for a time associated with Proctor, Redfern and Laughlin, consulting engineers at Toronto, Ont.

M. S. Magas, S.E.I.C. (University of Alberta, civil engineering, 1952) is with the Department of Transport at Cold Lake, Alberta.

B. F. Simons, S.E.I.C., is a lieutenant with the Royal Canadian Signals and will be stationed in Korea for the next 12 months.

Until recently, Mr. Simons has been at the Royal Military College at Kingston, Ont.

A. E. E. Stewart, S.E.I.C., who graduated in chemical engineering from the University of British Columbia in 1951 is working at the Ioco Refinery of Imperial Oil Limited, in British Columbia.

Leonidas Zarifi, S.E.I.C., is with the R. E. Stewart Construction Company Limited at Sherbrooke, Que.

Mr. Zarifi graduated in civil engineering from McGill University in 1952.

D. E. Coates, S.E.I.C., is with Canadian General Electrical Company at Toronto, Ont.

Mr. Coates graduated in electrical engineering from the University of Toronto in 1951.

A. Hendry, S.E.I.C. (Queen's University, engineering physics, 1952) is employed as a junior research officer in the radio and electrical engineering division of the National Research Council, at Ottawa, Ont.

R. R. Guenett, S.E.I.C., is employed with the Lincoln Electric Company at Leaside, Ont.

Mr. Guenett, graduated in electrical engineering from McGill University in 1951 and was for a time a student engineer with the Canadian Westinghouse Company Limited at Hamilton, Ont.

R. W. Hodgson, S.E.I.C., is a metals inspector with the Imperial Oil Limited at Dartmouth, N.S.

Mr. Hodgson graduated in mechanical engineering from the Nova Scotia Technical College in 1951.

H. A. Hinton, S.E.I.C. (McGill University, civil engineering 1952) is at the Ernest Harmon Air Force Base, Stephenville, Nfld., with the Corps of Engineers.

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R. E. Irwin, S.E.I.C. (Queen's University, mechanical engineering, 1951) is a flying officer in the aeronautical engineering branch of the R.C.A.F. at Lachine, Que.

R. B. Jackson, S.E.I.C. (University of Manitoba, mechanical engineering, 1952) is with the Canadian Westinghouse Company Limited at Hamilton, Ont.

D. L. Jones, S.E.I.C., is employed in the export division of the Ford Motor Company of Canada Limited at Windsor, Ontario.

Mr. Jones graduated with a B.A.Sc. degree in engineering and business from the University of Toronto in 1950.

Visitors to Headquarters

J. W. Mahon, S.E.I.C., Halifax, Nova Scotia, May 27th, 1952.

M. W. Huggins, M.E.I.C., Toronto, Ontario, May 27th, 1952.

E. P. Muntz, M.E.I.C., Hamilton, Ontario, May 27th, 1952.

C. G. R. Armstrong, M.E.I.C., Windsor, Ontario, May 27th, 1952.

W. N. Venables, Jr.E.I.C., Saskatoon, Saskatchewan, May 29th, 1952.

T. C. Main, M.E.I.C., Edmonton, Alberta, May 29th, 1952.

E. G. Allwright, M.E.I.C., Goose Bay, Labrador, June 4th, 1952.

J. L. Tiedje, M.E.I.C., Sarnia, Ontario, June 4th, 1952.

T. M. Rogers, Sarnia, Ontario, June 4th, 1952.

Sir Robert Watson-Watt, London, England, June 4th, 1952.

E. R. Mills, Oxford, England, June 6th, 1952.

J. D. Wilson, Jr.E.I.C., Dartmouth, Nova Scotia, June 6th, 1952.

H. G. Farish, London, England, June 8th, 1952.

J. B. Wilkinson, M.E.I.C., Hamilton, Ontario, June 9th, 1952.

G. E. Traub, M.E.I.C., Edmonton, Alberta, June 10th, 1952.

P. K. Harkow, Helsinki, Finland, June 11th, 1952.

A. C. Northover, M.E.I.C., Cornerbrook, Newfoundland, June 12th, 1952.

R. B. Johnson, Regina, Saskatchewan, June 14th, 1952.

A. D. Margison, M.E.I.C., Toronto, Ontario, June 17th, 1952.

Y. Savari, Helsinki, Finland, June 18th, 1952.

C. D. Schultz, M.E.I.C., Vancouver, B.C., June 19th, 1952.

Obituaries

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

A. C. D. Blanchard, M.E.I.C., civil engineer, died after a short illness, in Sidney, B.C., on June 10th, 1952.

Mr. Blanchard was born in Windsor, Nova Scotia, in 1878 and received his early education there. He graduated from Kings College, Windsor, in 1898 with a degree of M.A. and then continued his studies with a course in civil engineering at McGill University, where he graduated with a B.Sc. degree in 1901. His first engineering work was on the construction of the Canadian Niagara Power Company plant at Niagara Falls, Ont., rising to the position of resident engineer in 1906. In 1907 he joined the staff of the city engineer in Toronto and was engaged largely on trunk sewer construction until 1911 when he became city engineer of Lethbridge, Alberta. From 1914 to 1918 he was associated with the Greater Winnipeg Water District and later with the Hydro-Electric Power Commission of Ontario. He then became resident engineer on the Grand Falls Power Development on the Saint John River in New Brunswick.

In 1929 he joined the Montreal Engineering Company Limited. His first assignment was a long-range survey of the power requirements in Bolivia, South America. This involved a reconnaissance on mountain terrain at about 13,000 ft. above sea level, where most of the field work had to be carried out on foot or on muleback. Mr. Blanchard drew up a general plan of hydro development which became the basic scheme on which subsequent development was proceeded with. Following this he undertook a similar survey in the Republic of El Salvador.

His activities included a number of hydro-electric projects in Canada, one of these being the Mersey River Development in Nova Scotia, undertaken by the Nova Scotia Power Commission to furnish power for the Paper Industry in that district.

He was engaged in the planning of various power developments to supply the Avon River Power Company, furnishing power to the Annapolis Valley region, and later to the city of Halifax and vicinity.

He made studies for the installation of a series of power stations for the Newfoundland Light and Power Company, Limited. In the west he made studies of water conservation and utilization for Calgary Power Limited serving a large section of Alberta. In 1949 he retired from active work for health reasons and took up residence in Vancouver Island, but he maintained his interest in these studies up to the time of death.

Mr. Blanchard joined the Institute as a Student in 1901, becoming an Associate Member in 1904 and Member in 1911; he attained life membership in 1947.

R. D. Mershon, M.E.I.C., of Greenwich, Connecticut, U.S.A., died at Miami, Florida, on February 15th, 1952.

Mr. Mershon was born in Zanesville, Ohio, in 1868 and graduated from the Ohio State University in 1890. From 1891 to 1900, he was employed by the Westinghouse Electric and Manufacturing Company. In 1900 he entered private practice as a consulting electrical and manufacturing engineer in New York City, and in this capacity he designed and supervised many power plants and transmission systems in U.S.A., Canada, South Africa and Japan. Mr. Mershon was the inventor of the 6-phase rotary convertor, the compounded rotary convertor, systems of lightning protection for electrical apparatus and a compensating voltmeter; he has also written a number of technical articles. He served as chief engineer during the designing of the construction of the Niagara, Lockport and Ontario Power Company.

In 1912 he was president of the Alumni Association of Ohio University in which he was very active. He was one of four men responsible for the formation of the Reserve Officers Training Corps. In 1918 he was awarded the honorary degree of doctor of science by Tufts College. His achievements in the field of engineering won him the Lamme medal in 1932.

During World War I, he rose to the rank of lieutenant-colonel in the engineer corps.

He was an active member of the American Institute of Electrical Engineers, serving as vice-president from 1903-1905, president from 1912-1913 and he served on a number of the Institute committees.

Mr. Mershon joined the Institute as a member in 1904 and attained life membership in 1947.

C. C. Atkinson, M.E.I.C., of the Abitibi Power and Paper Company Limited, died at his home in Edmundston, N.B., on April 18th, 1952.

Mr. Atkinson was born in Melbourne, Que., in 1893 and after attending St. Francis College in Richmond, Que., he graduated in forestry engineering from the University of New Brunswick in 1921. He joined the staff of the Abitibi Power and Paper Company Limited at Iroquois Falls, Ontario in 1922, on forest surveys, later becoming pulpwood superintendent in charge of all pulpwood operations. He was associated with Fraser Companies Limited at Edmundston, N.B., in an executive capacity in the pulpwood department from 1933 until the time of his death.

A veteran of the First World War, Mr. Atkinson joined the 2nd battalion "D" company, Carleton and York regiment on its formation in 1940, becoming major and officer commanding the company in 1945, and retiring in 1947.

Mr. Atkinson joined the Institute as a Member in 1940; he was also a member of the Canadian Institute of Forestry.

D. J. Thomas, S.E.I.C., of Vancouver, B.C., died by drowning on April 28th, 1952, at Kapuskasing, Ont.

Mr. Thomas was born in Vancouver, B.C., in 1929 and received his early education in Vancouver and Nelson, B.C. He graduated in chemical engineering from McGill University in 1951 and joined the staff of the Spruce Falls Power and Paper Company at Kapuskasing, Ont.

Mr. Thomas joined the Institute as a Student in 1949.

Employment Service

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

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

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

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ELECTRICAL

ELECTRICAL ENGINEER required by University in B.C. to act as demonstrator for the session 1952-53 from Sept. 15 to May 31. Should be a University graduate in electrical engineering preferably under 30 years of age, with a knowledge of both electronics and power. Demonstrators are allowed to register for one post graduate course during the session if they so desire. Salary $2,000.00. Apply to File No. 4288-V.

ELECTRICAL ENGINEER with specialization in electronics or communications required by the National Film Board in Ottawa to maintain and to design and construct audio equipment. Experience in film or radio broadcasting industry including construction of audio amplifying equipment desirable. Starting salary $3,600. to $4,200. depending upon qualifications. Give full particulars to file No. 4289-V.

ELECTRICAL ENGINEER required to act as advisor to the board of the Gal Oya development project in Ceylon on all matters relating to electricity including the erection of HT transmission lines, the purchase of necessary equipment, and general problems connected with distribution of electricity throughout the Gal Oya valley. Salary equivalent to those paid in Canada, plus a substantial tax free allowance. For further details apply to File No. 4291-V.

ELECTRICAL ENGINEER recent graduate required for position covering Maritime Provinces, work to consist of design, draughting and field work for automatic controls and signaling. Apply to File No. 4292-V.

ELECTRICAL ENGINEER recent graduate required by organization in Montreal. Applicant should have capabilities to check shop installations and make layouts in accordance with preliminary outlines from senior supervision, a basic knowledge of industrial electronics, control applications and draughting. Apply to File No. 4300-V.

MECHANICAL

MECHANICAL ENGINEER required as sales engineer for oil company located in Montreal. Applicant should be preferably bilingual. Territory Montreal and area. Apply to File No. 4287-V.

MISCELLANEOUS

GENERAL BUSINESS and production manager required to take complete charge of a large modern plant manufacturing plywood, flush doors and hardwood flooring. This is a senior position with salary in line with experience and responsibility. Reply in confidence giving full detail. Location St. John's, Nfld. Apply to File No. 4286-V.

SALES ENGINEER required by nationally known manufacturer. Must have design or construction experience with power or telephone utility. Excellent future for young engineer with sales aptitude and willingness to work. Location Montreal with considerable travelling involved. Knowledge of French an advantage. Salary open depending on qualifications. Satisfactory performance of duties would lead to promotion to district manager Eastern Canada within 3 years. Apply to File No. 4290-V.

INDUSTRIAL ENGINEER required, manufacturer located in Province of Quebec. Applicant should be approximately 25 to 35 years of age, bilingual, and preferably married. Apply to File No. 4293-V.

SALES ENGINEER required in Montreal for contacting municipalities and contractors. Equipment consists of water and sewage piping, concrete blocks. Applicant should be recent graduate and bilingual. Excellent opportunities offered. Apply to File No. 4295-V.

SALES ENGINEER required for heating and ventilation equipment. Must have established industrial sales contacts in Montreal area. Apply to File No. 4296-V.

PRODUCTION CONTROL supervisor required immediately, capable of administering a large department comprising of the following divisions; material control, production control, stores, receiving and plant material transport. Large manufacturing company located in central Ontario. Permanent position for one who has the necessary qualifications. Apply to File No. 4298-V.

ENGINEER REQUIRED by large manufacturing company in central Ontario to act as correspondent for the export department. Applicant must be capable of handling correspondence from South America and have some experience with this type of foreign trade. Apply to File No. 4298-V.

INDUSTRIAL ENGINEER required by firm of consultants located in Montreal. Applicant should be 30 to 45 years of age with experience in management consulting or in industry. Apply to File 4299-V.

GRADUATE ENGINEER required by large manufacturer in Ontario. Applicant should have some experience in general plant maintenance, problems and installations. Apply to File No. 4301-V.

SUPERVISOR MANUFACTURING methods and standards required by organization in Toronto. Applicant should have from 3 to 5 years experience in an industrial engineering department in a position of responsibility and should know present day motion-time systems. Apply to File No. 4302-V.

MECHANICAL ENGINEER 1952 graduate required for newsprint mill in Province of Quebec. Good opportunity for man interested in learning pulp and paper industry. Salary 300.00 per month. Apply to File No. 4303-V.

ENGINEERING SALES ESTIMATOR young man required by leading electrical manufacturer for estimating, quotations and sales correspondence for our department of industrial fans. Basic technical background required, excellent opportunity. Apply to File No. 4304-V.

MECHANICAL OR ELECTRICAL engineer, recent graduate, previous experience not necessary, required by railway in Ontario. Will be given progressive training in various departments as a foundation for future engineering position in the mechanical department. This railway is almost completely dieselized and this is an excellent opportunity for the right man. Apply to File No. 4305-V.

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate, interested in following employment in illumination. Apply to File No. 4306-V.

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

CHEMICAL

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

CHEMICAL ENGINEER who has had considerable experience in an analytical chemical laboratory required to take complete charge of a moderately sized chemical laboratory and do process control, inventory control and inspection work. Location Niagara Falls. Apply to File No. 4268-V.

CIVIL

YOUNG CIVIL ENGINEER required by large transportation company in Montreal for duties in bridge department and other railway structures. Apply to File No. 4251-V.

CIVIL ENGINEER for construction work on heavy industrial buildings. Applicant should be graduate engineer with experience on construction work and building layout. Apply to File No. 4263-V.

CHIEF ENGINEER required by heavy construction company with head office in Montreal. Candidates must be qualified engineers with long successful experience on major civil engineering works, with locating Canadian or U.S. contractors. Able to take full control of contracts estimate to final account. Experience on marine work an advantage. Apply to File No. 4265-V.

ESTIMATOR FOR steel fabricator in Edmonton. Experience; at least three years in taking off structural reinforcing and miscellaneous iron. State experience, salary earned and when available in first letter. Applicant enclose recent snapshot. Apply to File No. 4271-V.

ELECTRICAL

PROFESSIONAL ENGINEER with good electrical background and adequate experience to manage and plan maintenance and extensions to Hydro, gas and water utilities systems in a town in South Western Ontario with a population of 8,000. Very favourable living conditions. Salary in accordance with experience but in the range of $5,500.00 to $6,500.00 for the type of man desired. Apply giving age, education and brief outline of past experience. Apply to File No. 4238-V.

ELECTRICAL ENGINEER RECENT graduate for foreign service of large Canadian company to undergo development in preparation for a specific engineering assignment. To undergo 3 months training period in Toronto. Prefer single man. Apply to File No. 4239-V.

ELECTRICAL ENGINEER required by large organization in Ontario. Applicant should have 1 to 3 years experience preferably on a test course or with a utility, for specification writing, supervision of acceptance tests, liaison with manufactures, checking drawings, and comparison of tenders. Apply to File No. 4239-V.

YOUNG ELECTRICAL ENGINEER required who is interested in sales in the power and electronic fields. Applicant would be stationed in Ottawa, and would cover territory extending from Cornwall to Kingston, Pembroke, and all Northern Ontario and Quebec Mining areas. Apply to File No. 4242-V.

ELECTRICAL SALES ENGINEER required for Southern Ontario area with knowledge of motor design and application. Apply stating experience and salary requirements. Apply to File No. 4254-V.

ELECTRICAL ENGINEER with several years experience in wiring diagrams, switchboards, or the layout of generating stations is required for the Toronto design office of a large private firm. Prefer applicant with an A.M.I.E.E. and in the age range of 25 to 32. Ability to write concise and lucid technical reports is important. Company offers a pension plan, group insurance, blue cross and other benefits. Quote file number 15055. Apply to File No. 4262-V.

ASSISTANT PROFESSOR of electrical engineering required by university located in the Maritimes. Teaching two or more specified subjects within the field of electrical engineering including laboratory instruction, member of faculty and other duties as assigned. Graduate of a university with one or more years post graduate training in an accepted industrial graduate engineers training program or equivalent experience. Apply to File No. 4269-V.

MECHANICAL

MECHANICAL ENGINEER required in Ontario to design diesel power applications, study specifications and prepare estimates for industrial and marine power plants, pumping stations and diesel generator sets. Able to make up detailed instructions for shop fabrication of assemblies and to assist salesmen on calls requiring technical information. Prefer a man about 40 years of age with ten years experience in some heavy industry such as mining or construction work. Marine engine or shipyard experience valuable. Extensive training on General Motors diesel engines of all sizes will be provided. Apply to File No. 4240-V.

MECHANICAL ENGINEER 1950 graduate who would be interested in doing development and design work on equipment both large and small for use in the explication of radioactive materials to industrial, medical, and research purposes. Location Ontario. Apply to File No. 4260-V.

GRADUATE ENGINEER, preferably Mechanical Engineering with 8 years or more of engineering and production experience in industry. Age range 30-40 years. Duties will be to activate and coordinate a program for the improvement of manufacturing methods and facilities for several plants with the purpose of obtaining the most effective and economical operation. This will include improved operating methods, equipment, materials handling, plant layout and wage incentive installations. Starting salary range is $7,400-$8,700 although it could be higher if the right man is found. There is a good opportunity for advancement. Apply to File No. 4280-V.

GRADUATE ENGINEERS, preferably mechanical engineering with 3 or more years of industrial engineering experience in industry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment, materials handling, plant layout, and other aspects of factory operation. He will also make time studies to establish production standards for wage incentive installations. The starting salary range is $3,750-$4,300. There are good opportunities for advancement. Apply to File No. 4280-V.

MISCELLANEOUS

TRANSFORMER DESIGN engineer required by well established organization in Ontario. Real opportunity offered in an expanding organization for a progressive engineer. Five years distribution transformer experience desirable but not essential for the man possessing other suitable qualifications. Reply should include general personal data, detailed experience record, with specific regard to types of transformers designed and recent photo. Apply to File No. 4220-V.

SENIOR CONSTRUCTION administrative assistants to assist senior construction executives in administration of large construction program in Eastern Canada. Executive ability and thorough knowledge of construction procedures required. We also need construction office managers to take charge of isolated construction offices including payrolls, inventories, personnel records, construction reports, etc. Previous experience in complete charge of construction office required. Salaries open, excellent opportunities. Apply to File No. 4249-V.

SENIOR STRUCTURAL STEEL designer required by Montreal office of consulting firm. Salary open. Apply to File No. 4250-V.

THE CIVIL SERVICE COMMISSION is assisting in the recruitment of a number of communications engineers, radio engineers, telephone and telegraph engineers and submarine cable engineers for appointment to civilian posts for foreign service. Apply to File No. 4252-V.

ELECTRICAL OR MECHANICAL ENGINEER required in Ontario for industrial cycle conversion program. Apply to File No. 4253-V.

SALES ENGINEER FOR CENTRAL ONTARIO. Knowledge of woodworking, metal working, pulp and paper making machinery. Apply to File No. 4255-V.

YOUNG GRADUATE ENGINEER with diesel experience required by organization in Ontario for expanding production program. Also require engineer with some knowledge of diesel engine construction. Apply to File No. 4257-V.

ASSISTANT CHIEF ENGINEER required by large and progressive company manufacturing pulp and paper products, offers excellent opportunity for assistant chief engineer. Will be located in Ontario, work includes development design construction and maintenance on multiple plant basis requiring extensive experience. Salary in line with responsibility. Reply in confidence to File No. 4259-V.

SOILS ENGINEERS experienced in soil mechanics and foundations engineering, are required by a rapidly expanding organization. Graduate soils work desirable. Location Montreal, but some travelling required. Salary open. Apply to File No. 4266-V.

TECHNICAL SALESMEN required to act as company representatives in an area or product specialist with specified customers. Selling experience is preferred. Locations Montreal and Toronto. Apply to File No. 4267-V.

GRADUATE ENGINEERS 1951 or 1952 to act as liaison between customer and production. No experience is necessary however man must have definite ability and aptitude to sell. Locations Montreal and Toronto. Apply to File No. 4267-V.

CHIEF ENGINEER to take full and immediate charge of industrial office in Toronto. Applicant must possess excellent background in tools, jigs, dies, and special machine designing and must possess qualifications of directing approximately 50 men and maintaining client relationship. Highest salary for like position in Canada, with a future unlimited. Apply to File No. 4272-V.

FIELD AND OFFICE ENGINEERS urgently required in connection with large construction program in Eastern Canada. Excellent salaries. Write at once giving full background including present salary and salary expected. Apply to File No. 4273-V.

SALES ENGINEER required for permanent position by manufacturer in Quebec City. Salary, commission and expenses. Preferably French Canadian who is bilingual. Apply to File No. 4274-V.

CONSTRUCTION ASSISTANT personnel manager required by company undertaking major construction program in Eastern Canada. Under personnel manager directs entire personnel programme, including selection and processing of personnel, but is particularly charged with administrative functions such as establishment of procedures,

REQUIRED FOR WORK IN MONTREAL OFFICE. Four graduate mechanical engineers and four senior draftsmen with not less than three years experience in detailed design of high quality machinery parts.

REQUIRED FOR FIELD WORK IN ONTARIO. One graduate mechanical engineer with not less than three years experience in the installation of machinery and other mechanical equipment. APPLY TO: Manager, C. D. Howe Company Limited, 1421 Atwater Avenue, Montreal, Que.

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AERODYNAMICISTS
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Positions are available for experienced aeronautical engineers and draftsmen for employment on long term design and development projects.

Excellent opportunities for advancement in a rapidly expanding organization.

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This is a permanent position involving aerodynamic flight testing on conventional and jet-propelled aircraft.

A minimum of four years of aircraft experience is required, including two years of flight test work. Detailed knowledge of flight test methods and instrumentation, and some supervisory experience is essential.

Excellent opportunities for advancement in a rapidly expanding organization.

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PAID OVERTIME
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SEMI-ANNUAL SALARY REVIEWS

Write giving résumé of education and experience to

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classifications, and rates; review of promotions, problems covering employment agreements, leave, and pay. Qualifications: construction and personnel experience. Definite administrative ability. Salary open. Location St. John, N.B. Apply to File No. 4275-V.

TECHNICAL SALES ENGINEER, recent chemical, civil or mining graduate required by Montreal firm in chemical construction and process engineering field. Job involves some travelling, designing, estimating and supervising work. Good opportunity for advancement to responsible positions. Apply to File No. 4276-V.

YOUNG GRADUATE ENGINEER required by financial institution to make surveys of and write reports on industrial plants in the province of Quebec. Must be completely bilingual and preferably with some manufacturing experience. Permanent position, pension and insurance benefits. Salary according to qualifications. Apply to File No. 4277-V.

LARGE PETROLEUM MARKETING COMPANY in Eastern Canada requires the services of an experienced engineer to carry on research leading to producing and refining. Excellent opportunity for capable person. Replies in strictest confidence. Apply to File No. 4278-V.

CONSTRUCTION AND EQUIPMENT installation supervisor for newsprint mill to be erected in India. Applicant should have an engineering background and experience in mill construction and maintenance work and a working knowledge of mill operations from the process end will be helpful. Salary $12,000 per annum. Apply to File No. 4281-V.

METALLURGIST required by large organization in Montreal. Applicant will act as consultant for all materials used. Apply to File No. 4282-V.

ENGINEER REQUIRED by large organization in Montreal well versed in welding operations. Apply to File No. 4282-V.

Situations Wanted

MECHANICAL, M.E.I.C., 7 years experience in production, research and development, design, testing, tool design of gasoline and diesel engines and small mechanisms for mass production. Available on month's notice. Western Canada preferred. Apply to File No. 83-W.

ENGINEERING ASSISTANT to manager or president with 14 years of industrial experience and shop practice in mechanical, aeronautical and civil engineering. Knows well welding, internal combustion engines, jet propulsion, nucleonics, skilled in mathematics and physics, has personality and know how experience. Bilingual, 40 years old, married; M.E.I.C., M.A.S.M.E.; P.Eng., University graduate. Apply to File No. 140-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948), desires foreign employment in construction field. Four years experience on the location, construction and maintenance of highways and railroads both as engineer and foreman. Presently employed as resident engineer by contractors in railroad construction. Age 26, single. Apply to File No. 204-W.

CHEMICAL ENGINEER, M.E.I.C., P.Eng., middle thirties, married, veteran, eight years diverse experience; control laboratory chemist, inspection, installation, production, development, and research. Presently employed on practical research problems in corrosion and heat transfer. Apply to File No. 297-W.

CHEMICAL ENGINEER, B.Eng., McGill University, M.E.I.C., P.Eng., age 31, single, 7 years experience in development, control and production in pulp and paper industry. Presently employed in supervisory capacity. Desires responsible position with any organization located in vicinity of Montreal or Toronto. Apply to File No. 660-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., 20 years experience includes approval and type test work; design of power and lighting layouts; electric and diesel electric railway work; heating and air conditioning contracting. Versed also in administration; cost estimating and accounting; sales. Desires position calling for any of the above experiences, especially if emphasis is laid on the practical execution of the assignments. Available on approximately one month's notice. Apply to File No. 2101-W.

MECHANICAL ENGINEER, available for responsible position offering opportunity as representative, plant or assistant engineer. Experience includes design, construction and maintenance. Good working knowledge of French and German. Reply to File No. 2642-W.

CHEMICAL ENGINEER, M.E.I.C., McGill, age 32, married. Business administration training. Experience includes: management, supervision, sales, production, research, development and control. Synthetic resins, protective coatings, building products, fermentation, detergents, acids, explosives. Organic and inorganic chemistry. Bilingual. Presently employed. Apply to File No. 2850-W.

MECHANICAL ENGINEER, graduated 1947. Four and one half years experience in maintenance, installation and production. Desires production work with small Montreal manufacturing firm. Apply to File No. 3208-W.

GRADUATE MECHANICAL ENGINEER with several years experience in operation of plant seeks change of position to one requiring initiation and ability to accept responsibility at the executive level. Location preferably Quebec province but would go elsewhere in Canada dependent on nature of position offered. Apply to File No. 3355-W.

CIVIL ENGINEER, Jr.E.I.C., age 27, married, one child, desires position with responsibility, in sales promotion, and/or sales and design with a well established company. Five years varied structural engineering experience in wood, concrete and steel construction. Prairie Provinces or Ontario preferred. Apply to File No. 3340-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., A.M.I.C.E., P.Eng., age 40, with considerable experience since 1933 (including England, Canada and U.S.A.), in the design of reinforced concrete and steel structures (warehouses, factory buildings, power station, boiler houses, oil refinery plants, coal hoppers and bunkers, gas plants, apartment buildings, schools, hospitals, steel mills, chemical plants, supersonic test building and other industrial buildings, bridges), river engineering, waterworks; also estimating and surveying. Seeks responsible position in Ontario or Quebec. Apply to File No. 3369-W.

ENGINEER, EXECUTIVE, M.E.I.C., B.Eng., P.Eng. (Que.), 25 years varied experience, administration, planning and direction of design and construction, dams, earthworks, runways, roads and streets, waterworks, sewers, sewage plants, buildings, power plants. Initiative and ability to organize effectively. Good knowledge of accounting and legal aspects of construction. Desires partnership in consulting firm or opportunity in construction business where experience will be of value. Apply to File No. 3511-W.

MECHANICAL ENGINEER, M.E.I.C., age 35, married. Graduated 1948 (Germany). Experience: expert labour certificate in engine building. 7 years maintenance and supervision of ship's diesel engines (30-900 H.P.), 2 years plan layout, time and motion study, production planning, 1 year detail design and draughting on centrifugal pumps. Presently, since March, 1951, employed by Centrifugal pump manufacturing firm. Desires more progressive position in Montreal. Apply to File No. 3900-W.

ENGLISH CHARTERED CIVIL ENGINEER, A.M.I.C.E., age 43 years, married, one child, at present chief assistant engineer to county surveyor in England, seeks similar appointment in Canada with Provincial or Municipal authority. Wide experience in surveying, design, construction and maintenance of: steel and reinforced bridges and structures; highways, general civil and municipal engineering and administration. Five years commissioned service with Royal Engineers in U.K., India and Burma. Apply to File No. 3905-W.

LAND SURVEYOR, UNIVERSITY GRADUATE, approximately 3 years of Canadian experience, M.E.I.C., desires position, either as man in charge of land-surveying party, or as instrumentman, capable to do all the inside work, computations, etc. Accepts work anywhere, available on short notice. Apply to File No. 3908-W.

CIVIL ENGINEER, 1933 graduate, married, with car, 19 years experience (about a year in Canada), on design, erection and maintenance of mill buildings, chemical plants, apartment buildings, hospitals, highways, etc. Desires position in construction or work closely allied thereto. Presently employed, will be prepared any time after June 15th. Apply to File No. 3920-W.

ELECTRICAL ENGINEER, M.E.I.C., A.M.I.E.E., age 29, married, recently arrived from England and presently employed in the Maritimes. Experience: 5 years trade apprenticeship on dock and harbour installations, 4 years D.O. work including layout and estimating power and lighting projects, 4 years full time lecturer, 1 year sales and contracts with large manufacturer, and 1 year supervising maintenance of amplidyne controlled diesel-electric plant. Seeking position as a senior assistant with prospects of advancement in developing industrial or municipal undertaking. Apply to File No. 3922-W.

INDUSTRIAL & MANAGEMENT ENGINEER, B.A.Sc., U. of M., M.E.I.C., age 35, married, bilingual, thoroughly experienced in all phases of industrial and commercial organization and management. Background includes highly successful consulting work in a large number of companies. Desires responsible position with medium firm located preferably in Montreal. Apply to File No. 3923-W.

JUNIOR EXECUTIVE, age 31, married. Bachelor of Arts and Bachelor of Applied Science degree in civil engineering. Practical experience in surveying road and railroad construction, timber bridge and wharf design and construction. Very familiar with construction and logging methods and machinery. At present employed by British Columbia logging company in supervisory position in charge of a logging operation. Would take position with a company with openings in technical sales or as assistant to management. Able to take responsibility of a position requiring organizing and administrative experience and ability. Apply to File No. 3924-W.

PROFESSIONAL ELECTRICAL ENGINEER, 40 years, British, seeks position in Canada. Toronto, or Southern Ontario preferred. Higher and ordinary National Diplomas in Electrical engineering, with distinctions. Corporate member of The Institution of Electrical Engineers. 9 years as draughtsman, 12 years as executive engineer with electricity supply authorities on distribution and commercial activities. 3 years with British Air Ministry (Seconded). Apply to File No. 3925-W.

CIVIL ENGINEER, University of Saskatchewan, 1951, Jr.E.I.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

CIVIL ENGINEER, age 27, recent immigrant, 1st class honours B.E. degree, National University of Ireland (1950), D.I.C. for postgraduate course in the Theory and design of structures at Imperial College, London, England. Some experience in surveying. Presently employed at the design of buildings and other structures required for mining plants. Desires position which would give him some experience in reinforced concrete or steel design or construction. Location preferably Toronto or Montreal but will also consider others. Apply to File No. 3927-W.

YOUNG ENGINEER, S.E.I.C., B.A.Sc., chemical engineering, fully bilingual, desires position around Montreal, either in sales or in design. Very interested in the heating and ventilating field and also possessing some industrial experience. Apply to File No. 3928-W.

METALLURGICAL ENGINEER, Jr.E.I.C., age 28, single. One year's experience with electric furnace steelmaking and one year with melting department of magnesium and aluminum foundry. Interested in research and development work. Available by June 16th. Apply to File No. 3930-W.

PLANT ENGINEER, Mechanical, Queen's, 1944, M.E.I.C., 1947, six years with small food processing plant, wants position assistant or plant engineer with larger company. Experience comprises operation and maintenance of L.P. boiler, elevator, air conditioning and drying equipment, freon and ammonia cooling systems. Also responsible selection layout and erection of new ammonia plant,

chemical dehumidifier, and independent design of new type drier. Salary five thousand or more depending on location and permanence. Available about three months' notice to present employer. Preferred location central Canada or U.S.A. Apply to File No. 3935-W.

ELECTRICAL ENGINEER, M.E.I.C., P.Eng., graduate University of Alberta 1949, married, veteran, 31, presently employed by public utility as underground distribtuion and relay engineer desires position in Alberta. Previous experience in radar, and with heating and ventilating contractor. Would welcome position with responsibility. Interested in working into management position. Apply to File No. 3938-W.

ELECTRICAL & MECHANICAL ENGINEER, Jr.E.I.C., fluently bilingual; seeks position as maintenance or assistant plant engineer in: textile or paper mill; oil or chemical industry; electric power station. 3 years previous experience as project engineer and field work supervisor in: heating, air conditioning, piping, thermo electric power stations. Apply to File No. 3945-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc., 1948, M.Sc., 1950, age 26, married. Two years experience in responsible position with public utility. Experience includes distribution system planning, line design and construction, hydro-electric power generation and transmission, street lighting, estimating and system appraisal. Desires position in Western Canada. Available October 1st. Apply to File No. 3946-W.

CIVIL ENGINEER, U. of T. 1935, M.E.I.C., P.Eng. of Ontario. Desires position of Planner with a municipality, industrial concern or consulting firm. Experienced in design & construction of sewage and water systems, roadwork, power distribution, land survey, drainage, housing layout and town planning. 5 years Naval service on armament building, design & construction. Discharged with rank of Lt. Commander. Last 3 years associated with R.C.A.F. in civilian capacity, engaged in layout of buildings and design of services for defence projects across Canada. Apply to File No. 3947-W.

ELECTRICAL MECHANICAL ENGINEER, S.E.I.C., 1951 graduate, age 27, single, fluently bilingual, completed G.E. Test Course with summer experience as electrician, seeks employment for position leading to plant or maintenance engineer, in large or medium size plant located in Montreal. Salary exepcted $300. or better, will be available June 2nd. Apply to File No. 3948-W.

CIVIL ENGINEER, M.E.I.C., available for part time work Montreal area. Concrete, structural steel, timber designs, detailing, quantity take off, inspection service, etc. Available for short periods or other suitable arrangements. Apply to File No. 3949-W.

MECHANICAL ENGINEER, Jr.E.I.C., Queen's 1948, R.C.A.F., veteran, age thirty-one, married. Four years experience in basic heavy industry in supervisory production position. Available July or before if required. Apply to File No. 3950-W.

MECHANICAL ENGINEER, age 29, British. Hons. B.Sc. (Glasgow); Assoc. R.T.C.; M.S. (Illinois); A.M.I. Mech.E. Experience includes: student apprentice, 2 years Air engineering officer, Royal Navy, in charge of maintenance workshops, 3 years college lecturing at undergraduate level in heat engines and mechanics, 5 years varied research experience including lubrication, wear and strength of materials. At present employed as research engineer in U.S.A., desires suitable position in B.C. with expanding company where pleasant personality and intelligent application of engineering principles required. Apply to File No. 3952-W.

CIVIL ENGINEER, age 26, British, B.A. (Hons.), Cambridge. Desires position in British Columbia with Civil Engineering firm or construction firm to work preferably in field but not necessarily. Experience: as student apprentice, 2½ years in Royal engineers as 2nd/Lt. training recruits in bridging, roads, etc., 1½ years as Junior Design Engineer in County Dpt. of Public works in U.S.A. At present employed by firm of civil engineers & land surveyors in U.S.A. Apply to File No. 3953-W.

Jr.E.I.C. GRADUATE would undertake on part time basis calculations, quantities and drawings of structural design, reinforced concrete, underpinning, soil mechanics and stabilization, sewerage and sewage disposal, Water supply. Apply to File No. 3954-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C., married, presently employed. Over 25 years in pulp and paper industry. Supervising experience on design, installation and maintenance. Familiar with manufacturing methods. Desires responsible position with consultants, mills or manufacturers. Apply to File No. 3956-W.

CIVIL ENGINEER, B.S.E., University of Michigan, Canadian citizen. Varied experience in estimating and project management, some purchasing with medium size contractor. Desires similar work in Montreal, Ottawa, or Hamilton area. Apply to File No. 3960-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill 1950, recently completed two year graduate student engineering course with a large electrical manufacturer Primarily engaged in plant layout, plant engineering and methods. Age 32, married, ex-naval officer seeks employment in manufacturing, preferably with a smaller company. Apply to File No. 3961-W.

PART TIME WORK desired by graduate electrical engineer, power option. S.E.I.C., P.Eng. (Ontario). Evenings and week-ends in Toronto. Experienced in wiring design and lighting layout work. Apply to File No. 3962-W.

MECHANICAL ENGINEER, Jr.E.I.C., N.S.T.C., 1949, single, age 26, two years experience in technical and engineering departments of large Canadian chemical firm and one year in the pulp and paper industry. Desires employment in industrial engineering work. Apply to File No. 3966-W.

ELECTRICAL ENGINEER, U.B.C., 1947, Jr.E.I.C., P.Eng., age 28. Experience: one year test course, three years design and manufacture of control equipment, one year abroad in design office of a public utility. Desires responsible position. Available immediately. Apply to File No. 3967-W.

CHEMICAL ENGINEER, Graduate of University of Toronto, 1950. Married, presently employed by nationally known firm in the industrial engineering field. Interested primarily in position in either production or sales in Eastern or Western Canada, Western Canada preferred. Desires only a position where hard work and initiative will bring advancement. Available on short notice. Apply to File No. 3968-W.

QUALIFIED ELECTRICAL and mechanical engineer, aged 28, M.E.I.C., Graduate of The Institution of Electrical Engineers, graduate of the Institution of Mechanical Engineers, U.K. Immigrating to Canada in June 1952, experienced in organization and supervision of electrical transmission schemes up to 132KV. Also general industrial electrical installations. Seeks opportunity preferably with consultant, contractor or supply company but prepared to consider work in any field of electrical or mechanical engineering anywhere in Canada. Any reasonable offer considered. Apply to File No. 3969-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., 5 years experience in pulp and paper industry covering design, construction and plant engineering. Also experience in technical and economic evaluation of new developments for management and supervision of small project staff. Desires broader opportunity in pulp and paper or chemical field. Location irrelevant. Apply to File No. 3970-W.

CHARTERED MECHANICAL ENGINEER, British subject holding major English qualifications is now available in Toronto and is anxious to contact Canadian Principals with a view to taking up a permanent position at the earliest possible moment. Twelve years practical executive experience in the layout and equipment of large shops, garages and depots. Accustomed to the control of administrative, technical and shop staffs. Considerable experience of both design and estimating of all such equipment and services, including shop layout, pipe services, conveyors, cranes and other lifting equipment. Fullest knowledge in the preparation of specifications and reports, accustomed to dealing with purchasing staffs in connection with the placing of contracts. Highest references from Canadian and English executives to those interested. Apply to File No. 3974-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 honour graduate, one year's training in administration and supervisory work, and one year's experience in design of conveying equipment. Interested in design or production work, and also in employment in plant engineering or materials handling department of production organization. Available on short notice. Location irrelevant. Apply to File No. 3975-W.

MATHEMATICIAN, age 40, German, recently immigrated, Dr. rer. nat. Technical University Berlin, more than 10 years activity in responsible industrial, governmental, and University positions. Good experience in all branches of numerical analysis, in mechanics (ballistics, aerodynamics) and in theoretical physics. Various scientific publications. Own computing machine. Desires position in industrial company or research institute where mathematical knowledge and abilities are required. Willing to accept starting position with future possibilities. Available immediately. Apply to File No. 3977-W.

PHYSICIST, German, age 49, married, 4 children, 1930 promoted to Dr. phil. in physics at the University Leipzig (Germany). Presently located in Canada. Sound knowledge in experimental physics and mathematical calculation of the measurements. Worked as physicist for research work and development. Desires starting position in Physical laboratory, research work, test or instrument engineer. Prefer cable, metallurgical, or chemical industry anywhere in Canada. Available immediately. Apply to File No. 3978-W.

TWO YOUNG CIVIL engineers presently located in Montreal with six years' experience in reinforced concrete and steel construtcion, desire part time employment (evenings & week-ends) doing calculations and drawings. Apply to File No. 3979-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc., Manitoba 1944. Age 29, married, two children, veteran R.C.A.F. Extensive experience in design of reinforced concrete and foundations; plant layout and mechanical design in mining, chemical, and paper industries; checking field construction and estimating. Desires a position as plant engineer or with a consultant, preferably in Ontario. Apply to File No. 3980-W.

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

SALES ENGINEER OR MANAGER, P.Eng., M.E.I.C., A.I.P.E., B.A.Sc. (Mechanical) Toronto 1943, age 32, married, presently in Ottawa but free to locate anywhere and willing to travel. Fourteen years total training and experience, last seven with same employer, last three as district manager in charge of all operations. Accustomed to dealing with executives, professional people and federal government officers. Desires to represent manufacturer of specialty mechanical and electrical equipment or related work. Apply to File No. 3982-W.

ENGINEER, M.E.I.C., P.Eng., 30 years experience with competent designers and detailers associated, specializing in the efficient preparation of preliminary studies, designs, detail drawings, specifications and supervision of construction for small and large industrial buildings and miscellaneous structures. Desires to act as consulting engineer for individual parties or companies requiring industrial building development in the Maritimes, and Eastern Canada. Apply to File No. 3983-W.

ELECTRICAL ENGINEER, Jr.E.I.C., graduated 1950 desires employment with responsibility and opportunity. One year's experience in power apparatus sales, including substation layouts; 4 years as radar officer in R.C.A.F.; 5 years in telephone industry including both inside and outside maintenance and equipment engineering work. Married, age 31. Apply to File No. 3984-W.

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Border Cities

W. A. McDougall, M.E.I.C., *Secretary-Treasurer*

H. D. Keil, M.E.I.C., *Branch News Editor*

May Meeting

The regular monthly meeting of the branch was held at Assumption College on May 15. On this occasion the group was addressed by two speakers from the U.S. Rubber Co., Royalite Division.

The first speaker, Mr. D. W. Reed, covered the practical uses of Versalite, a new rubber resin. Following this Mr. O. R. Huggenberger described some of the differences between the various synthetic rubbers. Both talks were well illustrated with a wide variety of samples.

A film was also shown outlining the economies to be obtained by a conveyor system and illustrating the installation and splicing of one of the larger endless belts used in mining operations.

Ladies' Auxiliary

For the May meeting the Ladies' Auxiliary enjoyed a tour of the Red Cross building. Mrs. John Hunt, Miss Eden Lancaster and Miss Joan Girling of the Red Cross Corps conducted the tour and explained the facilities and work of the Red Cross in Windsor.

Mrs. Gerald Lusby, president, presided at the business meeting that followed. Mrs. Fred Ryder, Interest Group convener, reported on smocking and leather craft and a display of work was presented. Mrs. J. C. Aitken and Mrs. Eric Lang are conveners of the smocking group and Mrs. Gordon Kirkwood and Mrs. R. N. Robertson of the leather craft.

It was reported that plans were under way for the organizing of other activities such as women's and mixed bridge marathons and a bowling league.

At the close of the meeting tea was served by the social convener, Mrs. Don Sinclair. She was assisted by Mrs. J. Hoba, Mrs. F. Ryder, Mrs. J. Wyllie, Mrs. Joseph Brown and Mrs. D. Keil.

Calgary

C. E. McNevin, M.E.I.C., *Secretary-Treasurer*

Presidential Visit

President and Mrs. Macnab arrived in Calgary Tuesday, April 22.

At noon on Tuesday the president was the guest of the Branch executive at an informal luncheon at the Ranchmen's Club, followed by a discussion of Institute and Branch affairs.

The same evening President and Mrs. Macnab attended a dinner and dance in their honour at the Al San Club. Eighty-two members and guests were present.

"Inventions which make modern living better for mankind would not be possible without the engineer aided by the scientist," said Dr. Macnab, addressing the assembly.

The president was introduced by Tom Stanley, chairman of the Calgary branch, and thanked by J. J. Hanna. Besides Dr. and Mrs. Macnab, guests at the head table were Mr. and Mrs. T. Stanley, Mr. and Mrs. J. J. Hanna, Mr. and Mrs. Charles McNevin, Mr. and Mrs. Herman Hayes, and Mr. and Mrs. Harold Randall.

At 9 a.m., Wednesday, a party including the President, and Messrs. Harold Randle, J. J. Hanna, F. K. Beach, H. M. Hunter, G. H. Galbraith, W. H. Tate and C. E. McNevin, left Calgary for a field trip. On the itinerary were the Shell Oil Company's plant at Jumping Pound gas field, the Calgary Power Company's plants at Spray Lakes and Banff. Arriving at Banff at 5.30 p.m. the party was joined by Mrs. Macnab, a number of the wives of members, the executive of the Calgary Branch, and Banff members and guests.

Following a social gathering and dinner the President gave a brief informal address.

May Meeting

Designing of roads to resist frost action and the restriction wheel loads on highways during the spring were the solutions to eliminating the damage caused annually in areas affected by frost boils according to A. W. Johnson, engineer of soils and foundations for the United States Highway Research Board, Washington, D.C. Mr. Johnson spoke to the Calgary branch of the Institute in the Palliser hotel on May 21.

It was possible, Mr. Johnson said, to design roads which would have bases above the water table, but this was not enough without knowing the depth of frost penetration. If this were known frost susceptible materials could be replaced with base materials which were not affected by frost, to the depth of penetration.

To do this would be a simple matter according to Mr. Johnson if engineers had all of the figures available as to the moisture bearing qualities of the soil, climatic conditions, and loads which would be travelling over a highway.

Referring to the control of traffic as a means of protecting roads, he said that if this was to be done intelligently engineers must evaluate the degree to which frost action reduces the load-bearing capacity of a highway.

Tests were just beginning in the United States to determine the amount of reduction in load-bearing capacity. In the northern states it was being found that up to 60 per cent of the normal bearing capacity was lost on soils highly susceptible to frost boils.

But better equipment and methods were needed for predicting how much bearing capacity was reduced by heavy wheel loads and to determine when the load capacity started to decline so that it would be possible to know when it was advisable to place restrictions on roads. There was too, the problem of enforcement. Decisions had to be made to determine how many passengers buses would be allowed to carry, how much load tank trucks could be permitted to haul and the weight of loads of other vehicles.

Many communities were dependent on truck transport and Mr. Johnson said restrictions on highway loads affected the economy of such centres.

Mr. Johnson declined to give his opinion as to the depth of excavation which would be satisfactory for roads in this area. He said that a thorough study of local conditions would be necessary before he could give such an opinion.

R. M. Hardy, dean of the faculty of engineering of the University of Alberta, informed the meeting however, that charts compiled by Mr. Johnson and applied to soil conditions, wheel loads and other factors similar to those of Calgary, called for an excavation and fill with frost-resisting material to a depth of 22 inches. Calgary's post-war major thoroughfares, he said, were excavated to a minimum depth of 24 inches and during the current spring not one breakdown had been noted.

Considering a solution to damage by frost action, engineers must look to the economic, technical and legal aspects of the problem, Mr. Johnson said. If engineers were given money they could build roads capable of withstanding frost action—using the finest materials.

"But we wouldn't be engineers. Building roads to withstand frost action wasn't the problem; the problem was to build them as economically as possible," Mr. Johnson said.

Explaining the action of frost in the ground, Mr. Johnson said that water froze from the surface down, expanding as it froze to ice to about nine per cent more than its normal volume. If this freezing took place in a bed of coarse material such as gravel it pushed unfrozen water down and no trouble resulted. If freezing occurred in a fine silt, however, where the water existed as a fine film wrapped around each soil particle, water was attracted upwards. Water was brought upward, he said, because water tended to move in the direction of heat. Since heat was drawn upward from the ground as it froze, water under the surface was drawn upwards.

The process of attracting water continued until ice lenses, as thick as a glass case, formed under the pavement. Because of its expansion properties, the ice heaved the pavement creating the mounds observed in winter.

Warm temperatures in the spring melted the ice lenses under the pavement first, gradually melting to greater depths. Water nearest the surface which melted first, could not escape because of the impenetrable ice barrier below. The melted water under the pavement saturated the base material which consequently lost its bearing value because it could not be compacted.

It required more than 65 per cent moisture content in such soils before the effects of frost action became severe. Soil holding less than that amount could withstand the first freeze and the first thaw. Subsequent freezing however, resulted in additional heat loss which drew more moisture upwards and it was possible in this way, for sufficient moisture to be brought upwards to pass the 65 per cent mark and enable frost damage to occur.

The pressure of water being drawn up from underneath the pavement was just as serious as the loads pressing down from the surface.

Mr. Johnson said that several factors affected the susceptibility of soils to frost action. No material was completely safe. Even the best were subject to some

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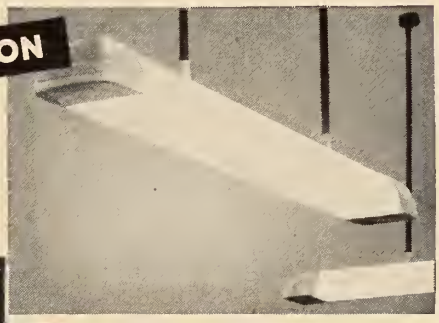

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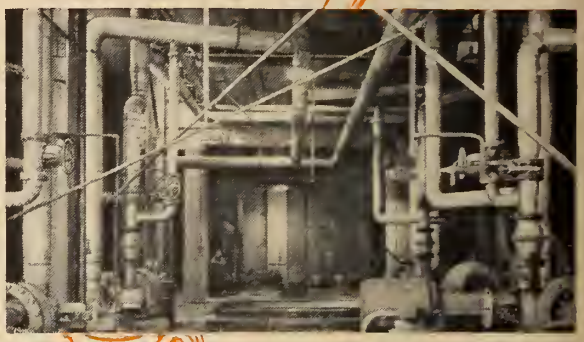
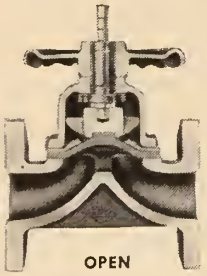
Bodies of this versatile valve are made in a variety of metals — iron, stainless steel, bronze, aluminum and others. *But of more importance* is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods, and KEL-F. This last is chemically inert to all acids and alkalies in all concentrations with the exception of molten alkali metals.

From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.

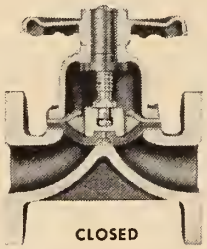


PULP AND PAPER MILL. Rubber-lined Grinnell-Saunders Valves on stainless steel piping handle sulphate pulp stock in a typical bleach plant.



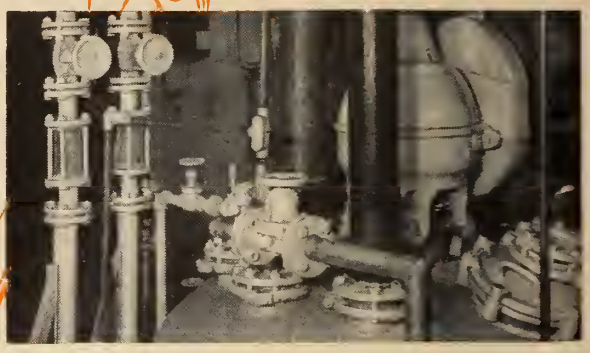
OPEN

Showing rising spindle . . . valves are available with rising or stationary spindle.



CLOSED

KEL-F diaphragm, using special rubber backing cushion and floating tube nut design.



CHEMICAL PLANTS. Glass-lined Grinnell-Saunders Diaphragm Valves, with KEL-F diaphragms, handle chlorinated organic chemicals in one plant of the chemical industry.

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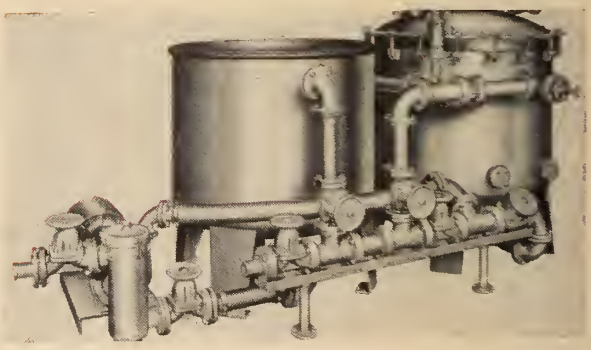

EQUIPMENT MANUFACTURERS. Grinnell-Saunders valves with rubber linings are standard on filtration equipment for solution clarification, on this manufacturer's equipment.

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softening but this was negligible because they were able to compact themselves and continue to bear loads which further compacted them. Permeability of soil was a major factor. Impervious soil was highly susceptible to frost action. but even more prone to damage was soil which was permeable enough to permit water to be drawn upward but not permeable enough to permit it to drain away.

Generally speaking, silts were this type of soil, Mr. Johnson said.

Fredericton

R. E. Tweedale, M.E.I.C.,
Secretary-Treasurer

Smoker, May 12

The Fredericton Branch entertained in honour of the graduating engineers of the University of New Brunswick at a smoker in the Lord Beaverbrook Hotel.

One hundred engineers were present at the function, which was under the chairmanship of Harold Marshall, M.E.I.C., entertainment committee chairman.

Dinner meeting, April

Fifty members of the recently formed Fredericton Branch of the Institute and their ladies met on April 18, in the Lord Beaverbrook Hotel for cocktails and dinner. They were entertained by the showing of a most interesting film on Newfoundland.

This was the second ladies' night held by the Branch and was most enthusiastically received by all present.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

Annual Meeting, June

The annual general meeting of the Kingston Branch, held on June 3 at the Kingston Yacht Club, took the form of a buffet supper, followed by a short business meeting, an address by a guest speaker, and finally a dance for members and their guests.

Following the buffet supper, Major A. L. MacLean gave a brief outline of the previous year's activities, stating that the year had been successful, judged by the attendance at all the monthly meetings. Mr. S. H. Rochester, secretary-treasurer, read his report and said that the finances of the branch were in excellent condition. One of the main achievements of the year was the issuance of the Branch by-laws. Lt.-Col. L. F. Grant, M.E.I.C., field-secretary of the Institute, then announced that Dr. F. M. Wood was the winner of the 1952 Gzowski Medal.

At the conclusion of the business portion of the meeting, the members and guests heard a very delightful and amusing talk by Dr. H. W. Harkness who spoke on the statistician and his effects on peoples' way of living. The speaker was thanked by Lt.-Col. J. R. Dunlop.

The results of the voting of next year's executive was reported as follows: Prof. J. S. Campbell, M.E.I.C., chairman; Mr. S. H. Rochester, M.E.I.C., vice-chairman; Mr. H. D. Forbes, M.E.I.C., secretary-treasurer. Serving on the executive committee are: Lt.-Col. J. R. Dunlop, O.B.E., M.E.I.C., R.C.E.M.E.; Mr. J. F. Williams, Jr.E.I.C.; Prof. C. H. R. Campling, M.E.I.C.; Prof. H. M. Edwards, M.E.I.C. Major A. L. MacLean, M.E.I.C.,

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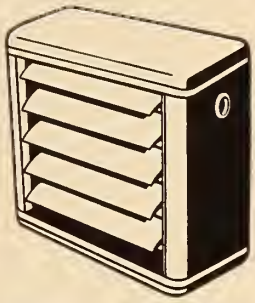

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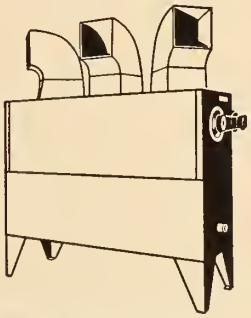

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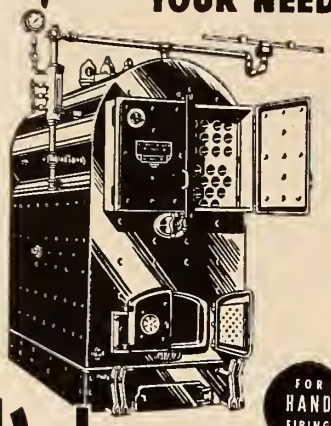

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is an ex-officio member of committee, and Mr. G. T. Andrews, M.E.I.C., councillor.

The chairmanship of the meeting was passed over to Prof. Campbell who adjourned the meeting.

Members and guests then enjoyed dancing to Mr. Bob. Turney's Orchestra.

Moncton

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

R. A. Park, M.E.I.C.,
Branch News Editor

Supper Meeting — May 13

"Probably the most outstanding deficiency among the physical assets of the Maritime provinces is the lack of a supply of cheap power." This was the keynote of a paper given at a supper meeting of the Moncton Branch of the Institute, May 13, when Frank S. Small, M.E.I.C., of Apohaqui, N.B., a retired engineer outlined the power possibilities that lie in the rise and fall of tidal waters of the Bay of Fundy.

It will be recalled that Mr. Small received the award of the Gzowski Medal at a dinner meeting of the Moncton Branch a year ago. The award was made for his paper on "A Plan for the Development of the St. Lawrence-Lachine Section" which was published in 1950. A graduate of Mount Allison and McGill Universities in civil engineering, Mr. Small is now retired after serving with such companies as Mond Nickel Co. and Fraser-Brace Engineering Co., Ltd., retiring from the latter in 1948.

Mr. Small, illustrating his talk with graphs showing hydro power development and population growth in several provinces and Canada as a whole, demonstrated clearly that the Maritime provinces have been the neglected area.

The illustrations showed that while Canada has now developed 13,000,000 horsepower in its hydro plants, the total hydro development in the three Maritime provinces is now only 286,000 horsepower.

Mr. Small related the power potential of the Bay of Fundy tides, in the order of 15,000,000 continuous horsepower for the head of the bay is more than the total now developed in the whole of Canada. A number of probable sites for the power development were described.

"Beyond a doubt," Mr. Small concluded, "there is enough power now going to waste at the head of the Bay of Fundy to transform the Maritime provinces from their present backward state into that of the most progressive section of the Dominion. The best method of harnessing this power is a problem that Canadian engineers can no doubt solve when called upon to do so."

E. M. Nason, branch chairman, presided at the meeting, and called on N. B. Eagles, newly elected councillor of the Institute, to introduce Mr. Small. The thanks of the meeting were voiced by W. D. G. Stratton.

Guests at the meeting were members of the Moncton Board of Trade and Town Planning Commission, and Mayor Arthur E. Stone, who brought greetings from the City Council.

Annual Meeting — May 26

W. D. G. Stratton, district airways engineer for the Department of Transport, was elected chairman of the Moncton Branch at the annual meeting held May 26 at the Moncton City Hall. He succeeds E. M. Nason, who as retiring chairman, presided at the meeting.

Other members of the executive elected are as follows: vice-chairman, R. T. Sansom; secretary-treasurer, V. C. Blackett; committeemen, M. F. K. Leighton, B. E. Bayne, R. A. Park, R. L. Parsons, H. Taylor, and H. J. Williamson. Ex-officio members of the executive are N. B. Eagles, branch councillor, and the immediate past chairman, E. M. Nason.

Reports of the various committees outlining their work during the year, were read, and the retiring chairman spoke of the activities of the branch during the year. He paid particular tribute to Mr. Blackett for his long and faithful continuous service and noted that his re-election to the office of secretary-treasurer marked the beginning of his 26th year in this office.

Peterborough

M. V. Powell, M.E.I.C.,
Secretary-Treasurer

J. G. Lucas, M.E.I.C.,
Branch News Editor

May Meeting

On May 28, 1952, Mr. A. Killaly delivered a paper on the story of the "Gut Dam" to the Peterborough Branch of the Institute. This subject was of particularly vital interest at the moment and Mr. Killaly was particularly well informed on the subject having been the engineer in charge of planning and construction of the dam.

Mr. Killaly's paper could be divided into three sections as follows:—(1) what was intended to be accomplished by the dam; (2) Other factors contributing to the rise in level of Lake Ontario besides the effect of the Gut Dam; and (3) what immediate steps might be taken to regulate the level of Ontario before the deep waterways are constructed.

Enlarging on these points, Mr. Killaly pointed out that the dam was intended to eliminate a bad cross current in the Galops Rapid Channel, caused by the direction of the discharge from the Gut, which made it difficult for vessels descending the channel to sail on the centre line ranges when travelling at their propelled rate plus the speed of the current, which is from 10 to 12 m.p.h.

In the late 1890's much concern was felt by Canadian engineers and Canada and U.S. promoters, for the future of the 14 ft. navigation of the St. Lawrence, then nearing completion, owing to what was then thought to be a permanent lowering of the water levels of the Great Lakes. It was confidently thought that the small amount of rise above the Gut Dam would be a definite benefit to navigation of the river and to harbours about Lake Ontario.

Another purpose intended to be served by the dam was to compensate for additional discharge out of Lake Ontario through the deepened Galops Rapids.

In addition to the effect of the Gut Dam, Lake Ontario has been raised by progressive deepening and widening of the channels in the Detroit and St. Clair Rivers, for the benefit of the increasing demands of inter-lake traffic.

Formerly natural restrictions in those rivers held Huron and Michigan to higher levels. With the enlargements of the flow areas in those rivers, water from Huron and Michigan—45,000 sq. miles of pondage—has flowed more freely into Erie and thence to Ontario. Thus the additional early flow from such a vast area has been a large factor in raising Erie and Ontario peaks above original natural conditions. Before enlarging the discharge capacities of Detroit and St. Clair Rivers, peak water was held longer in Huron and Michigan and did not reach Ontario until after its peak.

Additional "unnatural water" flowing into Lake Superior from Ogoki and Long Lake diversions contributes also to the rise. Superior being fully controlled, this unnatural water is simply quickly passed through Superior, Huron, Michigan, and Erie to Ontario. Occasionally ice stoppage at the Galops in sub-zero weather, affects the level.

Steps could be taken to regulate Lake Ontario before the deep waterways are constructed. It could be arranged to temporarily cease, or reduce inflow from Ogoki and Long Lake; or to restrict discharge from Superior to raise that lake, say 3 in., 6 in., or even 12 in. Such raising would only equal the mean high levels of Superior before its regulation.

If possible a temporary arrangement might be made with the United States Government under which they would require Chicago temporarily to increase the outflow from Michigan through the Chicago Drainage Canal.

The crest of the Gut Dam could be immediately reduced by say 1½ ft. to give additional discharge out of Ontario. The remaining portion of the dam will be a decided benefit to navigation of both U.S. and Canada promoters in preventing Ontario falling to levels attained in the past—even since the construction of the dam—if such should again occur before the proposed control works at Iroquois come into operation.

Sudbury

W. S. Black, M.E.I.C.,
Secretary-Treasurer

A. D. Finlayson, JT.E.I.C.,
Branch News Editor

Annual Meeting and Ladies' Night

The Annual Meeting and Ladies' Night was held at the Copper Cliff Memorial Community Hall, on May 3rd. An excellent dinner was enjoyed by the sixty-nine members, ladies and guests in attendance. Following dinner D. W. McKinty proposed the toast to the ladies which was very ably responded to by Mrs. W. F. Miller. The business meeting was called to order by chairman R. H. Moore, and an invitation was extended to the ladies to remain if they so desired.

After the introduction of candidates and the balloting the minutes of the last meeting and the annual report of the secretary-treasurer were in turn read and approved. The secretary read an official statement from Headquarters dealing with remarks made by President Macnab in connection with starting salaries for young graduate engineers.

Mr. Moore called on the chairmen of the various standing committees for their remarks on the past year's activities. P. R. McAdam, the branch representative on the nominating committee, reported on the nominations that had been made and stated that E. R. Eaton has been appointed as councillor for another term.

The chairman thanked W. J. Ripley for inviting out of town members and the executive to his home for refreshments prior to the meeting.

Mr. Moore addressed the meeting and remarked on the excellent attendance at both general and executive meetings. He dwelt on the formation of the North Bay branch and hoped that it will be possible to hold joint meetings between the two branches. In connection with future meetings he suggested that members inform the executive as to the type of papers that they prefer. In conclusion he expressed his appreciation for the manner in which the entire executive has worked with him during his term of office.

The results of the voting were as follows: chairman, W. F. Miller; vice-chairman, W. J. Ripley; committeemen, F. A. Orange, E. H. Jones, W. B. Ibbotson, and J. P. McCallum.

Mr. Moore turned the chair over to chairman-elect W. F. Miller. Mr. Miller expressed his pleasure at being chosen by the members to act as chairman and stated that he realized the great responsibility that has been entrusted to him. He stressed the importance of members serving on the various committees and pointed out that the co-

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operation of all members is required for the success of the branch.

After adjournment of the business meeting dancing was enjoyed for the balance of the evening. It was highlighted by a square dance which was expertly called by C. O. Maddock.

Vancouver

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

Field Trip

Approximately fifteen members of the Vancouver Branch enjoyed an afternoon inspection of the West Coast Woollen Mills on Wednesday, June 18. This Vancouver industry processes the raw wool from the sheep's back to yard goods. The group was conducted from the raw wool storage through the combing, spinning, dyeing and weaving operations. A large portion of the finer wool used in this industry comes from Australia after being combed and cleaned.

The plant produces a variety of fabrics from coarse mackinaw cloth to fine quality worsteds. Although small in comparison to Eastern woollen mills, the industry has plans for expansion in the near future and represents an important secondary industry for British Columbia.

The group extended their thanks to the management for their co-operation in making possible this field trip, which was arranged by Mr. E. A. Stanford and Mr. O'Neill of West Coast Woollen Mills Limited.

Student Branch

The University of British Columbia Student Branch of the Institute has announced the new executive for 1952-53. President is Vern McDonald, S.E.I.C.; honorary president, Prof. A. Peebles, M.E.I.C.,; vice-president, Norman Moysa; secretary-treasurer, Douglas G. Third, S.E.I.C.; recording secretary, George Faulder. Chairman of the film and speaker committee is Jack Brooks; and chairman of the membership and publicity committee is Frank Payne.

Vancouver Island

P. F. Fairfull, M.E.I.C.,
Secretary-Treasurer

Visit to Victoria

The Vancouver Island Branch members deemed themselves highly honoured when so many members from Eastern Canada accepted the invitation to visit Victoria, following the Annual Meeting.

Upon arrival on Saturday, May 10th, by C.P.R. Steamer from Vancouver, 75 visitors went on a sightseeing bus tour of residential Victoria, visiting many famous gardens which were at the height of their spring blooming season.

At 6.30 p.m., in the Lower Ballroom of Crystal Gardens, cocktails were served, by courtesy of the convenors of "Muriel's Room," Hotel Vancouver.

Dinner was served to 148 local and visiting members and wives. A. S. G. Musgrave, chairman of the V.I. Branch presided, and welcomed the guests on behalf of the branch members. This was the first occasion on which the branch had the distinct honour in welcoming both the President and the retiring President, accompanied by their wives. Many distinguished engineers from across Canada were present, including past presidents of the Institute and members of council.

At the head table, in addition to A. S. G. and Mrs. Musgrave, were President and Mrs. J. B. Stirling, Past President and Mrs. I. P. Macnab; Dr. L. Austin-Wright, general secretary; Col. H. G. Thompson and Miss M. McLaren, from Headquarters; Dr. Lillian M. Gilbreth, Honorary Member from Montclair, N.J.; Dominion Councillor R. and Mrs. Bowering, and Branch Secretary Cdr. and Mrs. P. F. Fairfull.

Dr. Stirling brought greetings from the new Council and Dr. Macnab spoke on the work done by the Institute during the past year. Short addresses were also given by Dr. Gilbreth who spoke on behalf of the ladies present, and J. G. G. Kerry, Life Member from Port Hope, who spoke briefly on the Annual Meeting.

Following dinner an informal dance was held in the Crystal Garden Flamingo Room.

After breakfast Sunday morning, the main body of the visitors left the Empress Hotel by bus for a pleasant trip over the famous Malahat Drive to Nanaimo and prior to boarding the C.P.R. Steamer for Vancouver, luncheon was held at the Malaspino Hotel.

The Vancouver Island Branch again wish to thank the Presidential party, the visiting members, and all who made this such a memorable occasion.

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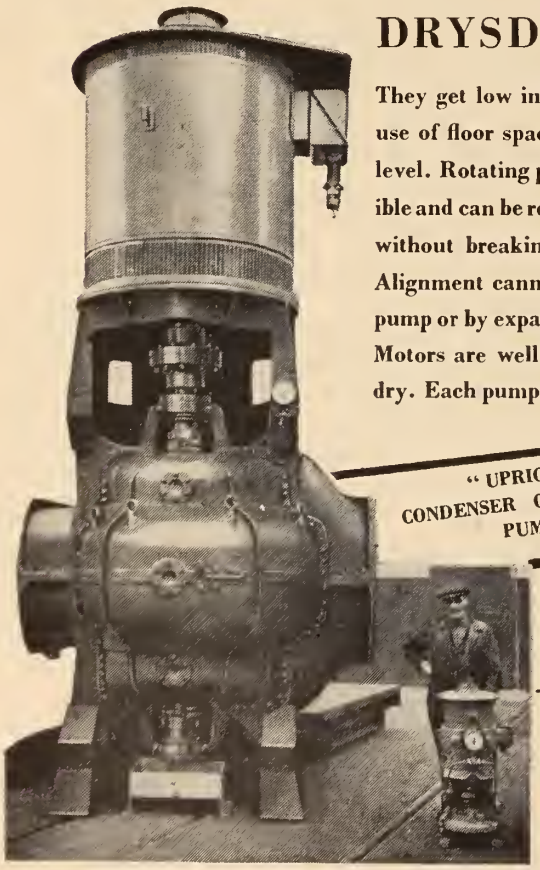

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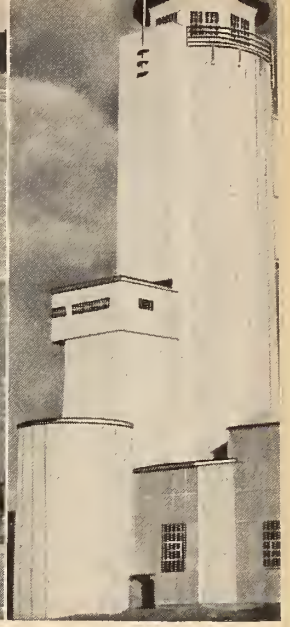

Canada's cement industry is currently laying out $17 million to raise production to 22 million barrels a year by 1953 — this though present production of 16.8 million barrels is only 5% below present demand.

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It is banking on a bigger Canada making greater per capita use of cement.

It anticipates broader, better highways; new and bigger power developments; greater use of cement for fireproof, time-and-blast defying houses, office, apartment, school, hospital and industrial buildings.

The increase in Canada's cement-producing capacity is a continued crescendo since war's end — up 45% in 1951 and 75% by mid-1952.

It is capitalizing also on years of investment in research for an improved product and more efficient methods of employing it, such as ready-mixed concrete, pre-cast concrete units giving faster, more economical construction and finer surface finish.

To quote from an article in "Saturday Night", "As suppliers of one of the prime materials required for the development of a growing country, the cement industry is determined to risk present overproduction in the interests of the future".

* * *

C-I-L pays tribute to the spirit of enterprise displayed by Canada's cement industry. It is proud to assist in expediting the work of Canada's mines and quarries generally by supplying dependable explosives and accessories, and by helping to promote their efficient, safe and profitable use. *Canadian Industries Limited, Explosives Division, Montreal.*

Facts about Cement

Since 1940 approximately 15,000,000 barrels of cement have been used for the construction of hydro-electric power developments in Canada. This quantity of cement would be sufficient to build a standard two-lane concrete highway 8″ thick and 22′ wide, from Halifax to Vancouver.

Housing construction in Canada has taken 4,000,000 barrels of cement a year since 1949, roughly equivalent to estimated requirements to complete the proposed St. Lawrence Seaway.

While the price of building materials generally has gone up 165% since the war, the price of cement has increased less than 50% on the average.

In *value*, cement represents 4% of Canada's mineral production — a quarter that of gold.

Portland cement is produced in Canada by St. Mary's Cement Company, St. Mary's, Ont., British Columbia Cement Company, Bamberton, B.C., Canada Cement Company with seven plants located in New Brunswick, Quebec, Ontario, Manitoba and Alberta, and by North Star Cement Company, Humbermouth, Nfld.

The Romans had a type of cement, but after the fall of Rome cement-making was a lost art for over 1000 years. The word "cement" is derived from "caementum", chips of marble.

"Portland Cement" was patented by an English bricklayer in 1824. He called it "Portland" because it resembled stone quarried near Portland.

The first hydraulic cement in Canada was made at Hull, Que., in 1840. Portland cement was first imported into America in 1868, and the first cement mill was established in 1872.

The cement quarry near Montreal provides materials exactly right for making cement, and contains enough to last for a hundred years.

Canada Cement Company alone used over 800,000 lbs. of explosives in 1951.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Plan for the National Capital. (1) General Report submitted to the National Capital Planning Committee. (2) Atlas. National Capital Planning Service. Ottawa, Queen's Printer, 1950. General Report: 308 pp. Atlas, 20 plates. $10.00.

The capital city of Ottawa has a natural beauty which is rapidly being encroached upon by urban development.

Conscious of this danger, the government formed a National Capital Planning Committee, the members of which have evolved a master plan for the organization and protection of the vast areas of urban, rural and wooded territories.

The report of this committee is presented in four parts, namely: general survey; justification of proposals; schedule of execution; and general recommendations.

The general survey includes physical conditions, history of the capital and urban evolution, housing, and public services.

Justification of proposals discusses the various proposals as put forward in the general survey, and includes plates and plans of suggested highways, parkways, streets and parking. Public services and urban planning are also considered.

Schedule of execution presents short and long range operations; and general recommendations is a résumé from the point of view of legal aspects, aesthetics, circulations, zoning and public relations.

Two hundred and ninety-four pages of text carry more than an average of one illustration each. The majority of these are photographs, mostly in black and white, but a few are in colour. A number of them are plans, either present or proposed, of various sections of the National Capital Region.

The interested reader is reminded that a planned system of parks and restful places within the city simply necessitates the reservation of appropriate lands, which from their natures, do not readily lend themselves to building and technical development purposes. Similar suggestions are to have the school and the playground adjacent to each other; to have a National Stadium which will include comprehensive sports facilities, gymnasium, swimming pool and training grounds.

Such planning should establish a series of greenbelts surrounding the urban zone, and at the same time allow a sufficient reserve for the eventual establishment of public services as they may become necessary in future building programmes.

The majority of maps in the Atlas annexed to the General Report are in colour. There are twenty in all, and they range from a general map of Eastern Canada and the United States, to a model of the central area of the Capital, scale one hundred feet to one inch.

These two volumes merit the attention of all of our readers interested in any type of city planning, and of Ottawa in particular. E.K.

BOOK NOTES

Advantages of the gray iron casting process and products. C. O. Burgess. Cleveland, Gray Iron Founders' Society, c1951. 28pp., illus., $1.50.

This booklet describes such functional advantages of the use of castings as rapid translation of design into finished product, dependability in service and possibility of production of a complex part as a single unit. It also shows the economic advantages, such as savings in machining cost, reduction of waste, economy of production of single units and moderate pattern cost. A comparison is made between gray iron and other cast metals, as to cost, fluidity, shrinkage, design freedom and other properties. Tables, diagrams and many photographs are included.

Aircraft publications: 15 pamphlets. Scranton, Penn., International Textbook Co., Laurel Publications, c1943. Illus., total price $20.55, in Canada.

Aircraft riveting. 37pp., $1.15

Airframe assembly tools. 28pp., $1.65

Basic problems and heat treatment. 35pp., $1.15.

Bending, drawing, rolling and spinning. 48pp., $1.35.

Cast and molded dies. 68pp., $1.00.

Drop hammers and press brakes. 35pp., $1.00.

Forming by hydraulic and crank presses. 76pp., $1.00.

Hydraulic and stretch presses. 43pp., $1.35.

Lofting and layout. 49pp., $1.50.

Mock-up. 39pp., $1.00.

Reproduction of lines. Part 1, 63pp., $1.00; Part 2, 65pp., $1.00.

Spot welding of aluminum alloys. 75pp., $1.00.

Steel dies. 57pp., $1.00.

Templets. 49pp., $1.00.

The above are fourteen of a seventeen-pamphlet series on aircraft fabrication, published by Laurel publishers. In spite of the copyright date, these booklets have been revised where necessary and merit the attention of our aircraft minded members.

Building construction cost data. 10th ed. R. S. Means. Duxbury, Mass., R. S. Means, c1952. $3.30.

The object of this work is to provide average spot prices of a variety of building construction items. The prices quoted were usually averaged for the United States, although in some cases they were obtained from a particular locality. Some data accumulated from actual job costs in 1951 and the quotations of the material

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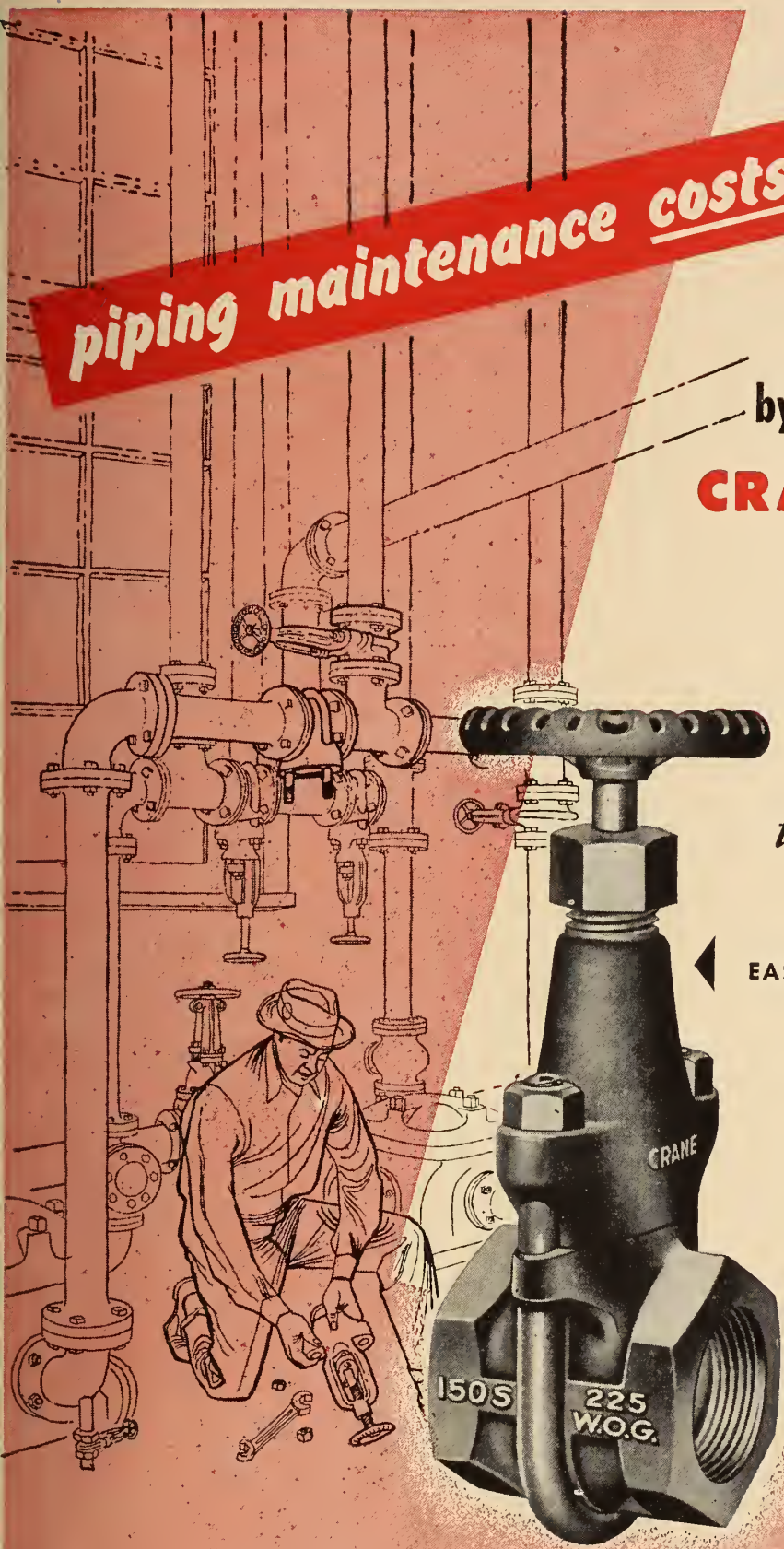

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dealers for 1952 have been combined with the January 1952 labour rates to revise previous figures. In the first part of the book the items are arranged alphabetically and are located easily by means of a thumb index. For each item, the following information is given: unit on which the price is based (square foot, cubic yard, etc.) labour cost, material cost and total. Numerous references are made to the second part of the book where breakdowns show how the author arrived at the tabulated figures.

Materials handbook: an encyclopedia for purchasing agents, engineers, executives, and foremen. 7th ed. G. S. Brady. Toronto, McGraw-Hill, 1951. 913pp., maps, $11.50.

The first part of this volume (eight hundred pages) lists, in alphabetical order, about a thousand materials, giving for each one its properties and uses. Thus, paragraphs or brief chapters on indium, industrial jewels, ingot iron, ink and insecticides, follow each other. The second part, called "Elements of materials economics", is much shorter and is divided in chapters on the following subjects: geophysics of materials; elementary geology of materials; elementary nuclear physics; fundamentals in the production of plant and animal materials; waves and colors as material elements; property of flavor in materials; fundamentals of biotic materials; industry terms; physical properties of materials. In most of these chapters, more space is devoted to tables and graphs than to text. Also included are a list of films, a list of units of measure and a list of agencies of the U.S. government dealing with technical aspects of materials resources. This book contains a very long and detailed index, but no illustrations except for American tree leaves and some world production maps. Although intended for people connected with science and industry, this encyclopedia would be worthy of any public or private book collection.

Radio and television receiver trouble-shooting and repair. A. A. Ghirardi and J. R. Johnson. Toronto, Rinehart, c1952. 822 pp., illus., $7.20.

This book will help the service technician to recognize and identify characteristic symptoms of trouble. It shows the best step-by-step procedure to quickly locate the faulty components and teaches the proper methods of replacing or repairing them. It is assumed that the reader is familiar with the fundamental theory of electricity and electronics. The accent, however, is on practice. Although its contents are arranged in an order rather more practical than academic, some effort has been made to render this volume useful to technical schools. Summaries and lists of questions and answers accompany each chapter. This volume is illustrated with photographs and diagrams and is indexed.

Refrigeration principles and practice. Ezer Griffiths ed. London, Newnes, Toronto, British Book Service, c1951. 579pp., illus., $8.50.

The present volume brings together the results of investigations in the fields of biology, physics and engineering, and applies them to refrigeration problems. It is therefore a presentation of existing knowledge for the refrigeration user, the refrigerating engineer and the plant designer. The main concern is with the best methods of chilled and frozen preservation of food, gas storage, refrigerated transport by land, sea and air, and the use of refrigeration in the processing of foods. Much of this information can be directly applied to problems in the design and performance of refrigerating plant. Other matters to receive attention are very low temperatures, the heat pump and air conditioning. This book contains many photographs and diagrams, a buyer's guide (for the British user), a glossary, and a detailed index. Bibliographical references are given at the end of each chapter.

Rise of the new physics: its mathematical and physical theories (formerly entitled "Decline of mechanism"). 2nd ed. 2 Vols. A. D'Abro. New York, Dover, c1951. 982pp., illus., $9.60.

The present century has witnessed the emergence of two great theories of mathematical physics: the theory of relativity and the quantum theory. The aim of the author has been to give a semi-popular presentation of the growth of these new ideas, starting from the most elementary notions and giving due consideration to the mathematical development without which the new theories could never have been constructed. This book is divided into three parts. Part one deals with the fundamentals of natural philosophy (in relation to physics). Part two contains chapters on mathematics and a review of the more important physical theories of the classical period. In the third part are discussed the various quantum theories and is included preliminary mathematical information necessary to their understanding. In the last chapter, the author has examined the present status of the doctrine of causality in the light of recent discoveries. This work is well indexed and is illustrated with diagrams and 36 portraits.

Surface area and volume of dished ends. D. E. W. Aldous. Manchester, Emmott, c1952. 23pp., illus., 2/6.

Hitherto, the methods for calculating surface areas and internal volumes of dished ends were lengthy, tedious and unavoidably inaccurate. Through formulae and graphs, a simpler and more precise method is here presented. The formulae will not be of much use by themselves, but the resulting graphs which are included in this volume will be found to be simple and easy to work with. The present work is divided into two parts, the first dealing with surface and the second dealing with volume.

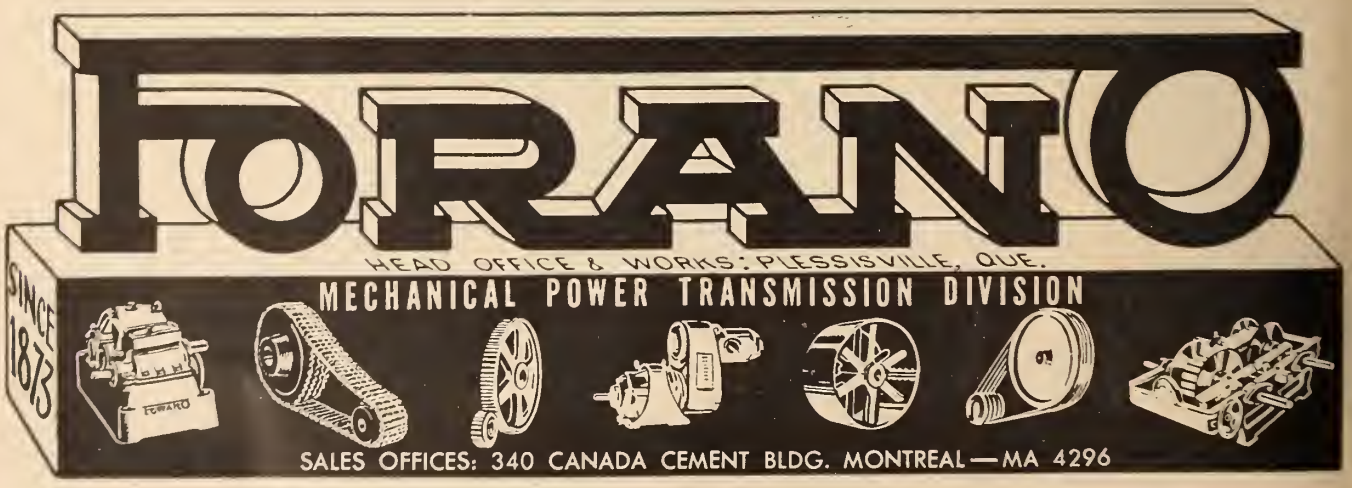
Westinghouse architects' and engineers' data book, second revised edition. Canadian Westinghouse Company. Hamilton, The Company, 1952. 330pp., illus., $5.00.

Arranged with loose leaf binding for easy reference, the products in this data book have been divided into four sections, namely: Power plant; Electrical distribution; Utilization and accessory equipment; and Engineering data. Tab indicators and a heavier stock page facilitate quick reference to these separate sections, and each one has its own table of contents, and is arranged alphabetically. In addition, all equipment has been standardized to give information under the headings of Sales engineering, Service engineering, Consulting and application engineering, Research, Manufacturing and Manufacturing and repair. In short, for many of our electrical members, this data book will be a very worthwhile addition to the office bookshelf.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Design of insulated buildings for various climates. T. S. Rogers, New York Architectural Record, 1951. 119pp. illus., $6.60.

Part I provides simple explanations of the principles which determine the proper construction of buildings to cope effectively with climatic problems. Part II is a working manual of recommended practices in heat and vapour control and structural ventilation, dealing with practical designs for insulated roofs, ceilings, walls, and floors. Design tables give basic data



for solving most of the problems encountered by builders. Recommendations are related to the major climate zones in the United States in order to give equal help for all locations.

Electrical measurements. F. K. Harris. Montreal, Renouf, 1952. 784pp., illus., $9.60 (Can).

Comprehensive coverage is provided from basic principles to applications within the fields of d-c and low-frequency operation. The theory, construction, and functioning of all important instrument types are dealt with in broadly classified sections. In addition to providing a working knowledge of methods and apparatus the author stresses the suitability, limitations, and necessary precautions in the use of special techniques. In an early chapter the origins, relations, and dimensions of electrical units are discussed.

Fluid flow in pipes. H. McClain. New York, Industrial Press, 1952. 123pp., illus., $3.60.

A summary of modern theory in the flow of liquids and gases through piping and ducts. The book deals in a concise, simple manner with viscosity, friction, turbulence, steam-line flow, head, and other factors which influence the over-all result. Dimensional relationships are emphasized. Practical applications and detailed worked-out examples help to clarify the handling of piping problems.

Foundations of high-speed aerodynamics. With a bibliography compiled by G. F. Carrier. New York, Dover, 1951. 286pp., illus., $2.25 (Can.).

A compilation of facsimiles of nineteen fundamental studies as they were originally reported by the investigators, arranged chronologically from Rankine in 1870 to Tomotika and Tamada in 1950. It is not actually a book on aerodynamics, but rather a coverage of the various subdivisions of compressible fluid theory. An extensive bibliography is classified under the following: hodograph method; Rayleigh-Janzen method; Prandtl-Glauert method; supersonic flow; shock waves; boundary layer; the oscillating airfoil and other unsteady flow phenomena; general.

Modern American engineers. Edna Yost. Phila., Lippincott, 1952. 182pp., $3.00 (Can.).

Written to encourage and guide young readers of high school age interested in engineering as a career, this book presents 12 biographical sketches of important contributors to the field of technology. The education, training and achievements of these representatives of various branches of engineering are given in a simple but comprehensive treatment, usually including a description of the duties and activities involved in each man's line of work.

New approach to engineering tolerances. J. Gilson. London, Machinery Publishing Company, 1951. 99pp., illus., 10s. 6d.

A critical presentation of the considerations necessary for the establishing and maintenance of realistic, achievable tolerances in modern economic production. After a general discussion the author deals with the effect of tolerances on fits and assemblies, with standard limit and fit systems, and the implementation of recommendations. The method of expressing tolerances on drawings is also covered at considerable length.

Nomography and empirical equations. L. H. Johnson. Montreal, Renouf, 1952. 150pp., $4.50 (Can.).

Two useful techniques are provided for handling experimental and operational data in business, industry, professional practice, and research. In the first part the characteristics and construction of nomographs are explained with examples of applications of various types. The section on empirical equations explains the methods of fitting curves to plotted data and establishing the corresponding equations. Proportional charts for laying out uniform scales are provided at the back of the book.

Radio Amateur's Handbook. West Hartford, Headquarters Staff of the American Radio Relay League, twenty-ninth edition, 1952. Various paging, illus., paper. $3.60 (Can.).

This standard manual of amateur radio communications covers the entire field from the fundamentals to the latest techniques in equipment design and construction. The considerable amount of technical data provided includes a comprehensive, up-to-date section of vacuum-tube data tables. The advertising section contains condensed manufacturers' catalogues. As usual the new edition has been revised to conform to current practice.

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Rigid frame formulas. A. Kleinlogel. New York, Ungar, 1952. 460 pages, $12.50.

Explicit formulas are given of all statical quantities for 114 rigid frame shapes which occur in practical steel, reinforced concrete, and timber construction. General and special load conditions are considered including temperature changes. The pictorial representation allows the use of the formulas for bending moments and reactions without advanced training. With training a rapid method is provided for computing displacements. The rigid frames given can be used as units in dealing with more highly indeterminate structures.

Thermodynamics of alloys. (Monographs and Report Series, No. 11), John Lumsden. London, Institute of Metals, 1952. 384pp., illus., $5.50.

This book deals with the application of thermodynamics to the quantitative study of phase equilibria in metals and alloys, with emphasis on the correlation of equilibrium properties. The theory is developed from first principles, with the mathematics kept as simple as possible. By selected examples it is shown how a comprehensive free-energy equation, derived from a suitable set of experimental measurements, can be reliably used to calculate all the equilibrium properties of a system.

STANDARDS

British Standards, British Standards Institution. 24/28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 232: 1952 — Vitreous-enamelled steel reflectors for use with tungsten filament lamps. 2/-.

This revised standard covers nine sizes of vitreous-enamelled steel reflectors, commonly known as the "open-dispersive type", having a light distribution classified in B.S. 398 as Class A III. It includes requirements regarding material, dimensions, luminous output, distribution of light, angle of cut-off, heating effects and selection of reflectors for testing.

B.S. 639: 1952 — Covered electrodes for the metal-arc welding of mild steel. 4/-.

A comprehensive scheme for testing electrodes is laid down. This involves initial tests to which each type or modified type of electrode is subjected, and periodic check tests which consist of a selection of the initial tests and which are to be repeated at intervals to provide evidence that the electrode currently produced continues to possess the properties recorded in the initial tests. Test methods are given for normal penetration electrodes, deep penetration butt welding electrodes and deep penetration fillet welding electrodes.

B.S. 1756: 1952 — Code for the sampling and analysis of flue gases. 10/6.

This standard covers not only flue gases from steam-raising appliances and heating boilers, but also those produced in the manufacture of iron, steel, non-ferrous metals, pottery, refractories, heavy clay ware, food, cement, glass, certain chemicals and coal gas. Methods are given for the determination of the following gases: carbon dioxide, oxygen, carbon monoxide, hydrogen, methane, moisture, oxides of sulphur and oxides of nitrogen.

B.S. 1842: 1952 — Double-ended open-jawed spanners for B.A. hexagon sizes. 2/-.

This British standard gives details of the dimensions, proportions, manufacture and material of open-ended spanners of the spear-head and round-head types suitable for hexagon sizes in the B.A. range, such as those given in B.S. 57 "B.A. bolts, screws, nuts and washers". Alternative head angles are given in the spear-head range so that on one form both bends are inclined at 15°, while on the other form one head is inclined at 45° with the other head in line with the axis. In the round head range, all heads are inclined at 15°.

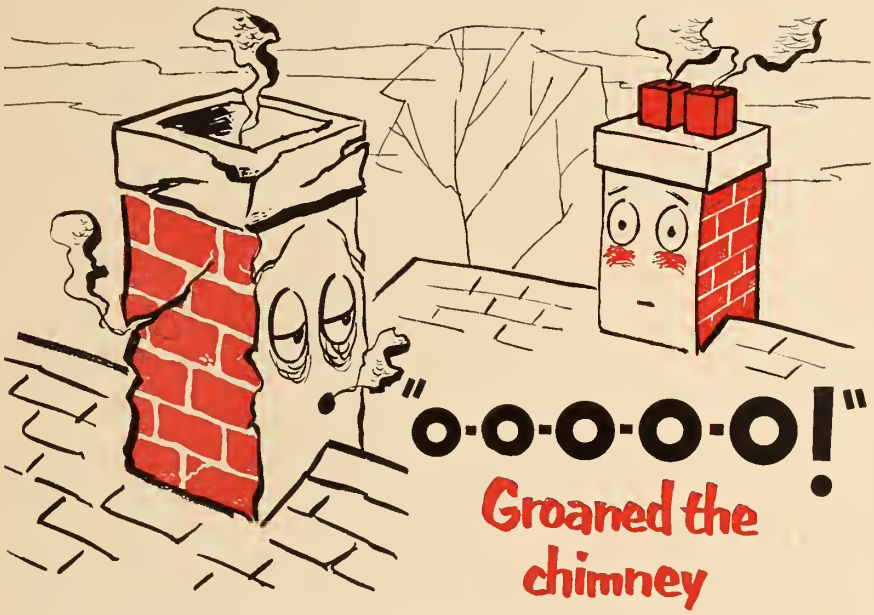
B.S. 1853: 1952 — Tubular fluorescent lamps (Class MCF/U). 2/6.

Since these lamps are available in a variety of colours and luminous efficiencies, they have been classified in this new standard under a series of codes. This work deals only with the 80-watt, 5-foot, hot-cathode lamp and includes information on the selection of lamps for testing, electrical requirements, marking, conditions of test, rejection, ratings, dimensions, life performance and methods of measurement.

Canadian Standards, Canadian Standards Association, National Research Building, Ottawa, Canada.

CSA W48.1: 1952 — Mild steel arc-welding electrodes. 3rd ed. $1.50.

The electrodes described in these specifications may be grouped according to operating characteristics, type of covering, or characteristics of deposited metals. Operating characteristics and type of covering are described in some detail, while characteristics of deposited metal are described only to the extent of mecha-



"I feel so bad I think I'm going to collapse."

"What's the matter?" asked his friend on the next roof. "You certainly look sick."

"I feel all weak and wobbly. My mortar is crumbling, and my bricks are beginning to fall out. Flue gas is playing hob with me. It gets caught in my bends, seeps through my mortar-joints, and—look at me. Would you call that a healthy complexion?"

"You certainly are a bad colour," replied his friend. "I think I know what's wrong with you. Look at me. Did you ever see a healthier chimney? Well, I have Vitrified Clay Flue Lining in my inside, and factory-made offsets at each turn. Keeps me protected from combustion acids. You don't find MY mortar crumbling, or MY complexion getting mottled."

Take the Healthy Chimney's advice. Insist on Vitrified Clay Flue Lining and factory-made offsets at each change in direction. They give permanent protection against corrosive action of flue gases and assure the life of your Chimney regardless of the type of fuel used.

VITRIFIED CLAY PIPE INDUSTRY
BONDED BY FIRE

12-2

nical properties. No requirements have been established for chemical composition or thermal characteristics.

TECHNICAL BULLETINS RECEIVED

Bell Telephone System. Monographs:

No. 1901 — Creosote penetration and sapwood depth in Douglas fir poles, by A. H. Hearn. No. 1902 — Subjective sharpness of additive color pictures, by M. W. Baldwin, Jr. No. 1903 — Some roots of an equation involving Bessel functions, by B. P. Bogert. No. 1904 — Low-frequency interference in television pictures, by A. D. Fowler. No. 1905 — Effect of pressure on p-n junctions in germanium, by H. H. Hall and others. No. 1906 — Data on random noise requirements for theater television, by Pierre Mertz. No. 1907 — Electrical properties of α Fe_2O_3, by F. J. Morin. No. 1908 — Translators and identifiers in switching systems, by H. H. Schneckloth. No. 1909 — Properties of p-n junction transistors, by W. Shockley and others. No. 1910 — Color television and colorimetry, by W. T. Wintringham. No. 1911 — Precise vector impedance measurement, by D. A. Alsberg. No. 1912 — Electron-vibration interactions and superconductivity, by J. Bardeen. No. 1913 — Deterioration of organic polymers, by B. S. Biggs. No. 1914 — Physics as a science and an art, by K. K. Darrow. No. 1915 — The development of electron tubes for a new coaxial system, by G. T. Ford and E. J. Ford. No. 1916 — Ionization by electron impact in CO, N_2, NO, and O_9, by H. D. Hagstrum. No. 1917 — Bell system cable sheath problems and designs, by F. W. Horn and R. B. Ramsey. No. 1918 — Instantaneous compandors on speech channels, by J. C. Lozier. No. 1919 — Flow of holes and electrons in semiconductors, by R. C. Prim, III. No. 1920 — Telephone traffic time averages, by John Riordan. No. 1921 — The TD-2 microwave radio relay system, by A. A. Roetken and others. No. 1922 — General theory of symmetric biconical antennas, by S. A. Schelkunoff. No. 1923 — Artificial dielectrics for microwaves, by W. M. Sharpless. No. 1924 — Reproduction of magnetically recorded signals, by R. L. Wallace.

BOOKS RECEIVED

Chill-cast tin bronzes. D. Hanson and W. T. Pell-Walpole. London, Edward Arnold, Toronto, Longmans, Green, c1951. 368pp., illus., $15.00.

Comprehensive bibliography of cement and concrete, 1925-1947. F. O. Slate. Lafayette, Indiana, Purdue University, Engineering Experiment Station, 1952. 491pp., $6.00.

Engineering materials: their mechanical properties and applications, Joseph Marin. New York, Prentice-Hall, 1952. 491pp., illus.

Exhaust hoods, 2nd rev. ed. J. M. DallaValle. New York, Industrial Press, c1952. 146pp., illus., $4.20.

Frost action in roads and airfields: a review of the literature 1765-1951. A. W. Johnson. Washington, Highway Research Board, 1952. 287pp., illus., $3.60.

Four-place influence line tables for moments, shears, and reactions in continuous beams over 2, 3, 4, and an infinite number of spans with stiffness ratios varying from 1 : 1 to 1 : 2 by increments of 0.1. Gustave Griot. New York, Frederick Ungar, c1952. 87pp., $4.50.

Manual of British water supply practice. A. T. Hobbs, ed. London, Institution of Water Engineers, c1950. 910pp., illus., maps, 50/-.

Mechanics of vibration. H. M. Hansen and P. F. Chenea. New York, Wiley, London, Chapman, c1952. 417pp., illus., $9.60.

Packaging annual catalogue of Great Britain, 1952. London, Tudor Press, 1952. 215pp., illus.

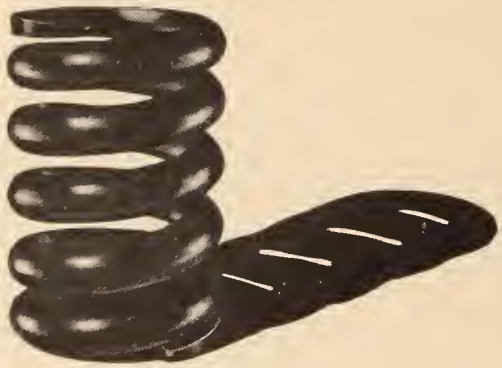
Strain gauges: theory and application. J. J. Koch and others. Eindhoven, Philips Technical Library, Houston, Elsevier Press, c1952. 95pp., illus., $3.30.

PAMPHLETS RECEIVED

Fundamental study of Sterling V. Vol. 5, No. 1. Boston, Godfrey L. Cabot, 1952.

History and development of the 567 series General Motors locomotive engine. E. W. Kettering. London, Ontario, General Motors Diesel, 1952.

Preparing the land for building. Part 1, Surface drainage. Part 2, Underdrainage. J. L. Staunton. Ottawa, National Research Council, Division of Building Research, 1951. (Reprinted from the Architectural Record, May and July 1951.)



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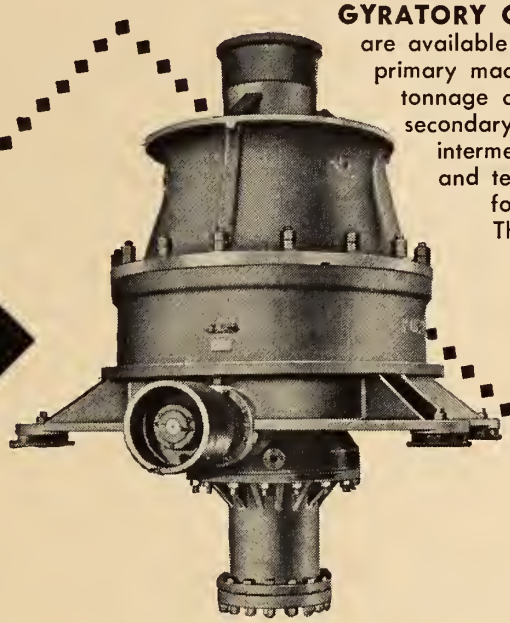

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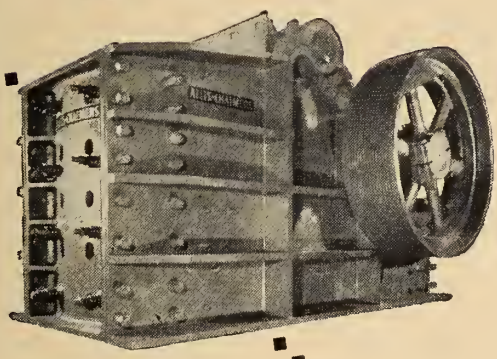

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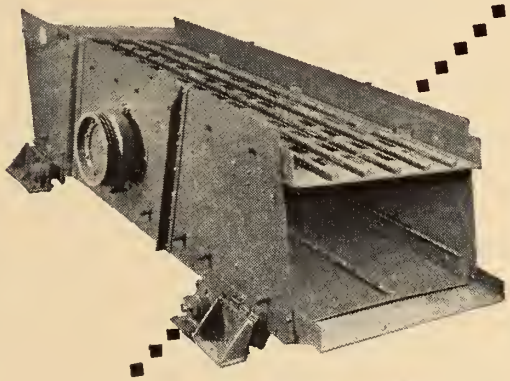

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CANADIAN ALLIS-CHALMERS

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

Appointments and Transfers

A. G. Lester.—The Department of Defence Production recently announced the appointment of A. G. Lester, Montreal, to the new position of associate director of the Electronics Division. Mr. Lester has been loaned to the department by his company, the Bell Telephone Company of Canada for whom he has been general operations supervisor in Montreal. During World War II, Mr. Lester served with the Royal Canadian Signals and in 1945 was technical staff officer in the Directorate of Electrical Communication Design at National Defence Headquarters, Ottawa. Since 1945 he has filled various engineering posts with the Bell Telephone Company, including that of supervisor of plant extension, where he was responsible for the overall co-ordination of the Company's construction program.

From October, 1949 to June, 1950, Mr. Lester attended National Defence College at Kingston as the first representative from industry to that college.

•

Defence Production Appointments.—Announcement was made by the Minister of Defence Production of the appointment of A. P. Craig, vice-president, Canadian Westinghouse Company Limited, as director of the Department's Shipbuilding Division. Mr. Craig will be assisted as director by Mr. William Cunningham as deputy director. Mr. Cunningham has been loaned to the department by the Red Barge Line Limited, Vancouver, B.C., of which organization he was general manager.

Mr. Craig graduated in electrical engineering from Cornell University in 1928 and joined the Westinghouse Company in the United States. During World War II he was in charge of construction and equipping of war plants built by his Company for naval production. In 1946 he came to Canada as assistant to the president of the Canadian Company and was elected vice-president in 1948. Mr. Craig also holds the position of vice-president and director of the Canadian Industrial Preparedness Association.

•

Ontario Hydro Scholarships announced.—Dean D. S. Ellis, M.E.I.C., Faculty of Applied Science, Queen's University, announced recently the names of the three winners of the Ontario Hydro Scholarships established at that University.

The successful contestants were Leonard H. Bartelink, London, George Podolsky, Hamilton, and Ernest R. Corneil, Stamford Centre. These scholarships, valued at $300.00 annually, are known as the Hydro-Electric Power Commission of Ontario Scholarship in Engineering. They are awarded in each of the second, third and fourth years of the engineering course based on the final standings of the first, second and third years' work of the student in any engineering course related to the work of the Commission.

Similar scholarships are awarded to students at the University of Toronto and the Royal Military College at Kingston.

•

Canada Wire Appointments.—L. G. Lumbers, vice-president of Canada Wire & Cable Company Limited, Toronto, has announced the appointment of J. O. Young as regional manager of the Company for Manitoba, Saskatchewan and North Western Ontario. Mr. Young's headquarters will be in Winnipeg. Mr. F. Heseltine continues as Regina district manager of the Company.

•

J. R. Phillips.—Mr. J. R. Phillips has been elected a vice-president of Phillips Electrical Works Limited, Brockville. He has been general manager of the firm for the past six years and will continue in that capacity.

Mr. Philips is a chartered accountant and joined the staff of the Phillips Electrical Works Limited as assistant secretary and assistant treasurer in 1940. Four years later he was appointed assistant general manager and on January 1, 1947, was promoted to the position of general manager.

•

Dominion Oxygen Company Limited.—It has been announced by Stanley B. Kirk, chairman of the board of Dominion Oxygen Company Limited, that Thomas D. Cartledge has been elected president of the Company. Mr. Cartledge has been a director and vice-president and is also president of Linde Air Products Company, a Division of Union Carbide and one of the leading producers of oxygen and acetylene in the United States.

•

Monsanto Canada Limited.—The following personnel changes have been announced by Monsanto Canada Limited recently:

E. D. Moffat, plant manager of the Company's Montreal plant, was named production manager of the recently-acquired subsidiary, Barringham Rubber and Plastics Company, Oakville, Ontario, effective June 1.

Mr. Moffat graduated from the University of Alberta with a B.Sc. degree in chemistry in 1940. After being engaged in defence production at Winnipeg during the war, he joined Monsanto Canada in 1946.

D. D. Stokes, sales manager of the Adhesive and Resins Division at Montreal for the past two years, replaces Mr. Moffat as plant manager of the Montreal Plant.

Mr. Stokes is a native of England and graduated from Manchester University in 1931 with an honours degree in chemistry. He had wide experience in production research and technical sales with Monsanto, England, prior to joining the Canadian company as research director in 1948.

Dr. Frank J. Leger was appointed research director, with headquarters at Montreal.

Dr. Leger obtained his M.Sc. degree from the University of Alberta in 1932 and his Ph.D. from McGill University in 1938. Following two years in industrial work, he joined the National Research Council. He served from 1942 to 1947 as a major in the Canadian Army on various technical assignments. Prior to his appointment with Monsanto he was engaged in research on synthetic fibres and held the position of assistant director.

H. F. Dixon, assistant manager of Western Operations, succeeds D. D. Stokes, as sales manager of the Adhesives and Resins Division.

Mr. Dixon is a graduate from the University of British Columbia in chemical engineering and joined the Company at Vancouver in 1946.

D. A. Layfield, of the Toronto plastics sales staff, was appointed sales manager of the Barringham Rubber and Plastics Company, Oakville, Ontario.

Mr. Layfield has been a member of the Monsanto staff in Toronto since 1946 following the termination of his war service with the Canadian Army.

G. F. Parker has been transferred

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from Montreal to Oakville and will continue to be engaged in development work for the subsidiary and the parent company.

Mr. Parker is a graduate of McGill University in chemical engineering. He joined Monsanto's Montreal manufacturing staff in 1948, immediately following graduation, and has been concerned with plastics development for the past year.

•

Nordberg Manufacturing Co.—Announcement is made by the Nordberg Manufacturing Company, Milwaukee, Wisconsin, of the appointment of S. C. "Sandy" McComb as Western Canadian representative of the Nordberg Manufacturing Company's Heavy Machinery Division, with headquarters in Vancouver, B.C.

Mr. McComb studied at Cardiff Technical College in Wales and served his apprenticeship with Mount Stuart and Sherman Shipbuilding Company. Subsequently he sailed as an engineer in the Merchant Service for a number of years in the China Sea. In 1931 he became associated with Malcolm & Company, Shanghai, Hong Kong and Singapore, specializing in consulting engineering work, and in 1935 was named chief executive engineer of the Macaau Water Development Scheme in South China.

He served with the Royal Naval Reserve throughout the recent war and, following his retirement as lieut.-commander engineer officer in 1945, came to Canada, where he has been in business in Vancouver handling the sale of diesel engines.

•

Ferranti Electric Limited.—Announcement has been made recently of the promotion to district manager for the Quebec District of Mr. Charles E. Begin. Mr. Begin has been serving as acting district manager and will continue to maintain his office in the Tramways Building, Montreal, P.Q.

•

Peacock Brothers Limited.—Control Engineering Corporation of Canton, Mass., is pleased to announce the appointment of Peacock Brothers Limited as exclusive distributor in Canada for the Control Engineering Line of pressure pickups, strain gauge amplifiers and pressure measuring devices.

This equipment is designed to afford an accurate method of obtaining pressure-time curves for both static and dynamic pressure measurements in such fields as dynamometer test engines, gasoline, diesel or steam engines; hydraulic or pneumatic systems; detonation studies, etc. The equipment, based on a design of Dr. C. S. Draper and Dr. Y. T. Li of the Massachusetts Institute of Technology, utilizes a catenary diaphragm-actuated strain gauge exhibiting negligible temperature, calibration drift, vibration and mounting stress errors. The wide frequency response range of these devices allows accurate measurement from steady state to over 20,000 c.p.s. in pressure ranges of -15 p.s.i. to 10,000 p.s.i. The equipment has found wide usage throughout the world in many fields where accurate dynamic measurements heretofore had been found impossible.

•

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New Equipment and Developments

New Bus Duct Line.—A new line of prefabricated bus duct is now available through Canadian Westinghouse offices across Canada. Westinghouse bus duct provides secondary distribution of power with advantages of easy installation, reduction of power losses and complete flexibility of future arrangement without disturbing the original installation. Composed of copper bars suspended in steel housings by insulators, the new bus duct is made in four ready-to-install types, design tested and verified in the Westinghouse High Power Laboratory.

This modern system of power distribution is used outdoors from transformer to switchgear and indoors from switchgear to point of use.

•

Soil Pipe Cast by Centrifugal Process.—A new process for manufacturing cast iron soil pipe has recently been installed and put into operation at the St. Catharines plant of the Anthes-Imperial Company Limited.

This installation, the result of several years of engineering development and research, produces seamless and dimensionally correct soil pipe of electrically controlled weight at a rate far greater than the conventional "floor-cast" method.

Anthes-Imperial reports that this is the first installation of its type in the British Commonwealth and the second in the entire world. Although the process has been in operation for only a short time the superiority of the pipe has already received enthusiastic response from users throughout the country.

The process as installed is designed for the production of two, three, and four-inch pipe over a wide range of weights.

•

Concrete Monolith to block river flow.—On the Waneta Power Plant project which is being carried out by the Northern Construction Company and J. W. Stewart Limited for The Consolidated Mining and Smelting Company of Canada Limited, engineers are making final plans for a unique and spectacular construction feature. A giant pillar of concrete, 18 storeys high and weighing nearly 6,000 tons, will be tipped to fall over on its side into the river. The structure (usually called a monolith) will block the swift flow of the Pend-d'Oreille River through the south two thirds of its channel, enabling construction men to bare the river bed and erect a section of the dam.

The Waneta monolith, rising 180 feet above its concrete base on the river bed will be the highest on record, although not the heaviest. A similar monolith erected in the Saguenay River in 1930 was 92 feet high and weighed about twice as much. Another unusual characteristic of the Waneta monolith is that it will be tipped into place. In the past, monoliths have been blasted from their foundations and rolled into position.

The date for the Waneta monolith project will depend upon water levels. The foundation has only recently been completed, but will be under water until sometime in July. It is expected that the monolith will be ready for tipping in the late summer or early fall.

A cable attached to the top of the structure will be powered by a winch, which will pull the monolith off balance to start it falling freely. The direction of fall will also be guided by a steel hinge embedded in the bottom of the monolith and the base on which it is to be erected.

When the monolith strikes the river, water will be sprayed with firehose force. The cushioning of the water will slow its fall so that it will hit the river bed with the effective force of a drop of only a few inches. The face of the monolith which will rest on the river bottom will have an irregular shape, designed to fit the contours of the river bed. In position in the water, it will be 35 feet at the deepest point and thirty feet thick, tapering to ten feet at the top.

The Waneta Power Plant project was started in June of 1951 and is scheduled for completion late in 1953. The plant will have provision for four units. Two will be installed initially with a combined maximum output of 210,000 hp.

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Plate and Structural Steel Sales offers fast service on fabricated steel products that has won them nation-wide recognition. We specialize in custom built work in steel plate producing such units as tanks, hoppers, breechings, conveyors and light structural steel and machine bending.

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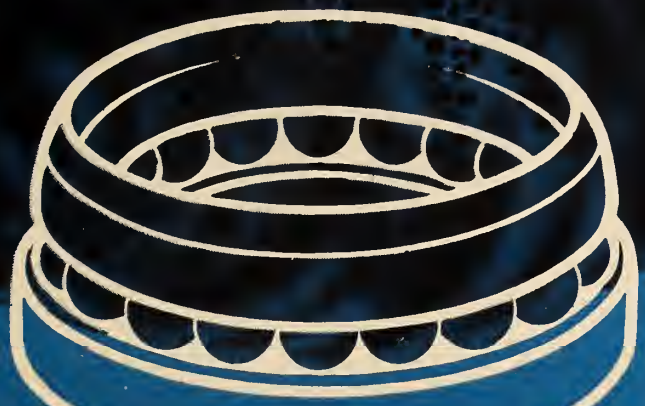
... A SIMPLE PRINCIPLE THAT WORKS

... AND WORKS



... AND WORKS IN A BABCOCK PULVERIZER

FOR THESE GOOD REASONS-

Instant response—Raw and re-classified coal drops to centre, passes out through ball race and is carried through classifier by the automatically adjusted air supply. At all times, enough properly pulverized fuel is maintained to meet any steam load change.

Fineness is maintained—Clearances between grinding elements do not change with wear, nor does their shape, throughout the life of the grinding elements.

Needs less power—The pulverized fuel is removed immediately from the grinding elements.

Coal, so wet that water drips continually from the feeder, is dried in the mill. Hot transport air passes through the coal, between and around the grinding elements. Mill capacity does not change with varying moisture in the coal.

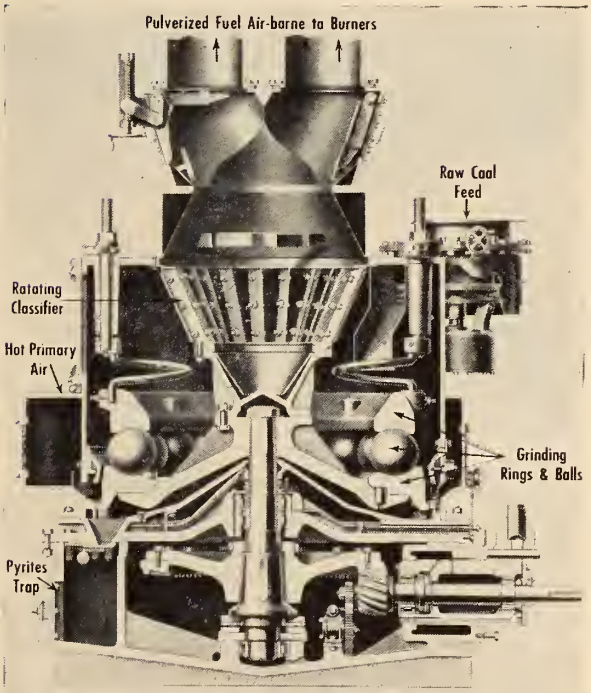
Feeding, drying, grinding, classifying, thorough aerating, and equal distribution to all burners, take place inside the unit.

Co-ordination of mill and burners gives stable operation over a very wide range of loads.

All parts quickly and easily accessible. Wear adjustments are made externally.

BABCOCK PULVERIZERS
sold in Canada, have a capacity of more than 4,000,000 pounds of coal per hour.

Consult us about your fuel pulverizing requirements



THE BABCOCK TYPE "E" PULVERIZER

BABCOCK-WILCOX AND GOLDIE-McCULLOCH, LIMITED • GALT, ONTARIO

MONTREAL TORONTO CALGARY VANCOUVER

Stone and Webster Canada Limited have been retained by Cominco for the design and general supervision of the power project and have contracted the excavation and construction of the dam and powerhouse to Northern Construction Company and J. W. Stewart Limited.

•

Sorel Industries Ceremonies.—On June 14th last a series of ceremonies took place at Sorel, Que., which were international in character. Prime Minister St. Laurent, Defence Minister Claxton, Minister of Defence Production, C. D. Howe, Hon. M.E.I.C., and high ranking officials of the Royal Canadian Navy, the U.S. Navy and the U.S. Army were on hand for the events. On this occasion the Arctic patrol vessel "Labrador" and the new-type wooden-hulled minesweeper "Chignecto", were christened. Both these ships were built at Sorel by Marine Industries Limited for services in the Royal Canadian Navy.

Another feature of the ceremonies was the presentation of the dual purpose 3-inch 50-calibre electronic naval guns being produced by Sorel Industries Limited for the navies of the United States and Canada. These guns are twin-mounted and the total weight of each mount is more than 16 tons—this weight however is so finely balanced that it will swing at a light hand pressure when power drives are disconnected. Each mount contains 192 non-ferrous castings, 81 ferrous castings and 145 different forgings.

This occasion marked the first time that major armament has been produced in Canada for United States use and emphasized the fact that Canada is making an important contribution to the defence of the free world.

•

Canadian B.S.A. Limited.—Associated with the Birmingham Small Arms Co. Ltd. of England, this Company has recently been incorporated in Canada, and the offices and plant are located at Sterling Avenue, Ville LaSalle, Montreal, where they have taken over the modern factory formerly operated by the O'Neill European Machine Company of Montreal.

This new Canadian organization is backed by the B.S.A. organization in England, which is well known in the field of small arms, cycles, motor cycles, machine tools, steel production, coupled with Daimler automobiles and buses.

The parent organization is also closely connected with the aircraft industry and is one of the larger manufacturers of jet turbine blades in England. Considerable of the metallurgical development of blades emanated from their subsidiary Wm. Jessop & Sons Ltd. of Sheffield.

The introduction of certain British techniques will be made within the Canadian unit which, for the time being, is assisting the Canadian aircraft industry on a number of contracts.

•

Isotope Products Limited.—An interesting observation has been reported recently by Dr. Donald C. Brunton, of Isotope Products Limited, Oakville, Ontario, in the use of isotope sodium 24 (radioactive sodium) for locating a break in the radiant heating pipe buried beneath a concrete floor. At the Toronto garage of John Labatt Limited, a leak developed in the 15,000 sq. ft. radiant heating system but could not be located by ordinary methods.

Dr. Brunton and his associates solved the problem by flushing a spoonful of washing soda which had been made radioactive in Canada's atomic pile through the system. When the radioactive solution had penetrated throughout the system it was flushed clear of the heating pipe and after the expiration of an appropriate lapse of time, the location of the leak was indicated by the greater intensity of radioactivity remaining at that point.

All operations were checked carefully by means of a geiger counter and a scintillometer.

•

New Six-Inch Dial Indicator.—Taylor Instrument Companies of Canada Limited have recently released information concerning a newly designed Dial Indicator which is ideally suited for modern instrument panels and equally desirable for individual mounting. This new instrument was primarily developed to meet the requirements of the many temperature, pressure and load applications in industrial processing. The Taylor 6-inch Dial Indicator has a high-visibility dial with white graduations

Cansfield TRANSFORMERS

unequalled for efficient, trouble-free service!

Cansfield Transformers are available in oil cooled, air cooled or furnace types, and special types can be designed for particular applications. Consult Cansfield engineers on your requirements.

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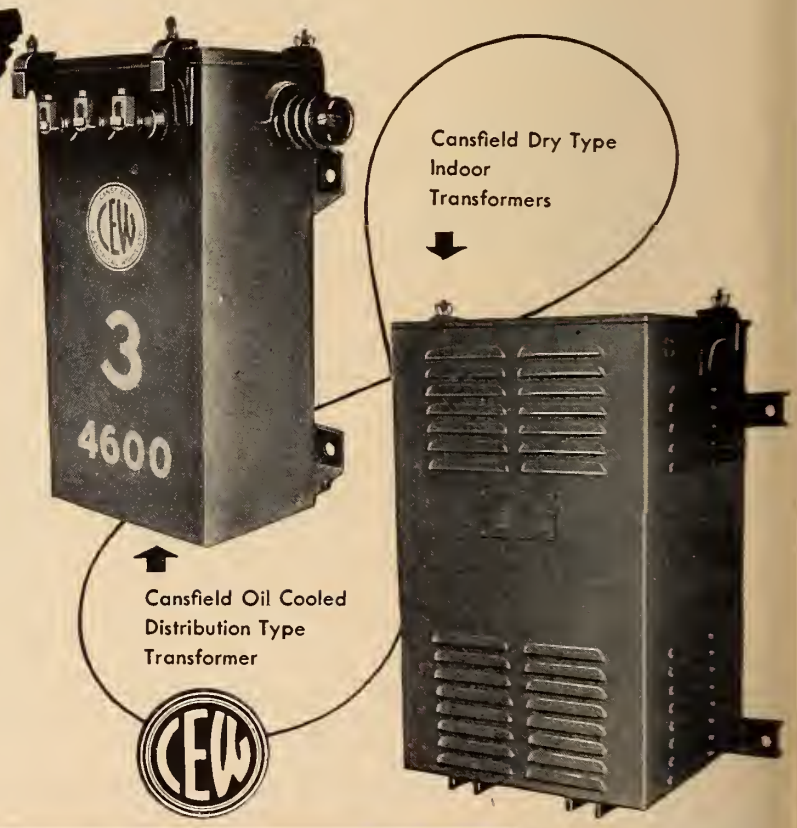
Transformers, Relays, Thermostats



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DUNHAM **vari-vac differential heating**

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Instantaneous response to outside weather changes.

Convenience of centralized operation.

Automatic compensation for heat loss.

Heat supply and demand perfectly balanced.

Send for Free Bulletin 520. Tells all you'll need to know about this amazing system—how it operates, how it may be fitted exactly to your needs. Write for your copy.

St. Joseph's Sanitorium, Montreal. Installation made in 1948.
Architect: Gagnier, Derome & Mercier. Consulting Engineer: Paul DeGuise.
Heating Contractor: J. A. Vaillancourt.

provides healthful temperatures under all conditions

Regardless of frequent and rapid changes in outside weather conditions, Dunham Vari-Vac* Differential Heating immediately compensates for these variations—always delivers the correct amount of steam required for maximum healthful comfort at all times.

Fuel Savings up to 40% are not exceptional in the Vari-Vac* heated building. This precision temperature control system economizes with a "continuous" flow of sub-atmospheric steam at pressures that vary with outside weather to maintain uniform inside temperatures. Heat supply and demand are always perfectly balanced—there is no overheating and consequent waste of valuable fuel dollars.

Choice of Systems to Suit Your Needs. Several different systems are available, depending on the degree of control desired. Whichever you choose—whether a simple, manually operated job or a fully automatic installation—you are guaranteed maximum comfort and fuel economy without regard for the size, type, age or location of your building.

**Variable Vacuum*

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and numerals on a black background. Its white wedge shaped pointer or indicator is provided with a micro-adjustment to permit easy and accurate zero settings. A notable feature is the new stainless steel movement which is designed to eliminate linkage errors.

The case of die-cast aluminum is so constructed that it may be easily face or flush mounted, bottom or back connected. The bezel and case are cast with breech lock threads which are quick acting and require less than ¼ in. turn to fully engage or separate. This ideal locking device holds the glass tightly against the recessed rubber "O"-ring to provide an effective seal against moisture and fumes.

The design of the instrument provides for almost universal actuation by any variable that makes use of a Bourdon spring as an energy-to-motion converter. *For temperature applications,* four different types of actuation are available: Mercury, Vapour, Gas or Organic Liquid (Monolex). Ranges from minus 100 to plus 1200 deg. F. *For pressure applications,* range spans from 12 to 20,000 p.s.i. are available. Tension and compression load elements can also be incorporated in the new instrument for load applications with ranges from 0 to 75,000 pounds.

For additional information write for bulletin 98214, Taylor Instrument Companies of Canada Limited, Toronto 1, Ontario.

•

Improved Submerged Arc Welds.—Fixing the cooling rate of welds made in medium alloy steels by the submerged arc process to improve ductility and control grain growth, is covered in a new booklet, "Predetermination of Preheat and Postheat for Submerged Arc Welding." Included in this booklet are the results of bend tests of weld beads deposited without preheating or postheating. These are compared with results of similar tests made with preheating and postheating for varying times and at various temperatures. The effect of increased carbon and alloy content on transformation of the steel is also discussed.

Diagrams are included to show the time-temperature relationship for complete isothermal change in twenty-four grades of S.A.E. steel. A table suggests postheat times and temperatures for these steels. Many other tables, diagrams, and pictures illustrate the booklet. This may be obtained without charge from Dominion Oxygen Company Limited, Montreal, Toronto, Winnipeg, and Vancouver.

•

New Space Heater on Market.—A new Thermobloc model has just been announced by T. C. Chown Ltd. of Montreal, which is capable of producing 2 million B.t.u. per hour output and will heat an area of from 16,000 to 24,000 sq. ft.

While the exterior has a smooth clean appearance with lines pleasing to the eye, the interior design is new and different. The Model 2,000 has twin heat exchangers arranged in the form of a "V". This results in maximum scrubbing of the heating surfaces by the air passing through. For discharge, diffusers give pin-point control of air throw. These outlets may be placed in any position desired. They can be rotated a full 360 degrees. Single ducts may be run from any outlet to adjoining rooms if heat is needed in these places. The model 2,000 may also be used as a central heating plant. In that case, a plenum chamber is supplied in place of the four diffusers.

The new Model 2,000 Thermobloc requires less floor space and less head room than most conventional space heaters on the market today. The normal air output is 22,000 cubic feet per minute, and the air intake velocity is 440 feet per minute. The fan is powered by a 10-hp. motor. The unit can use either light fuel oil, with a pressure atomizing gun-type burner; heavy oil, using a horizontal rotary cup burner; or gas, using a power burner. It may also be equipped with a combination burner for instantaneous conversion of gas to oil or oil to gas.

•

New Westinghouse Edmonton Office.—The Canadian Westinghouse Company recently opened another new building

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LONG LIFE
AND LOW COSTS FOR:

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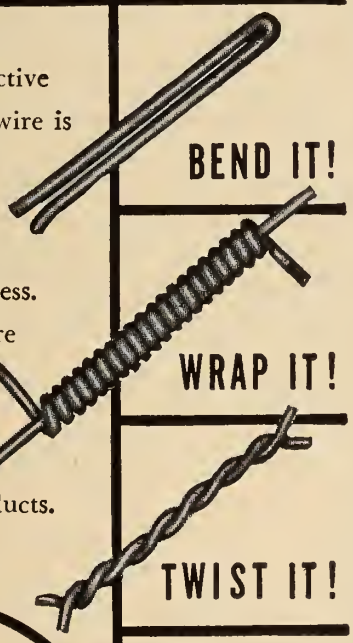

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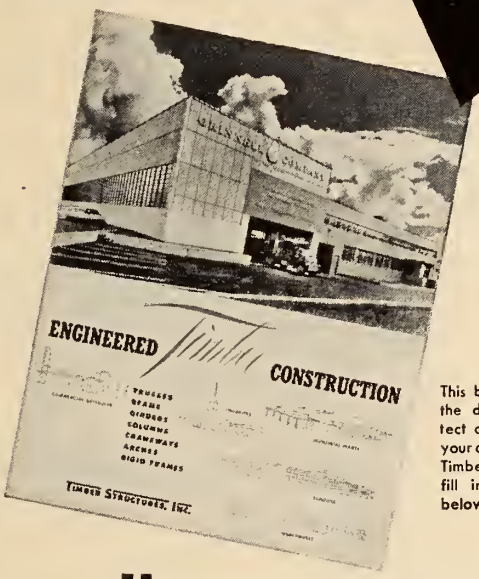
Permanent, Economical Construction



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under the company's nationwide expansion program. This latest addition is a $400,000 sales and service centre in Edmonton.

Roy L. Brown, vice-president and general manager of the Canadian Westinghouse Supply Company announced to the guests at the opening ceremonies that additional land had already been purchased for future expansion in order that the Company might have available at all times the products needed for the great industrial upsurge which has taken place throughout Western Canada.

•

Canadian International Trade Fair.—Officials of the Canadian International Trade Fair had just closed the door on the fifth annual Fair when they were looking for more space in which to accommodate the sixth annual gathering. Records were broken this year in all directions and products of 2,534 firms were on display from 29 different countries.

Of the business visitors a total of 24,142 were registered during the fair and these came from 62 different countries although 90 per cent were Canadians.

Applications for space at the 1953 fair are already in step with those of previous years and indications are that the fair next year will exceed all previous records.

•

Grinnell Company Montreal Warehouse.—A new branch warehouse and sales office was opened by the Grinnell Company of Canada Limited in Montreal last month. The building which is of modern design is located at 3980 Namur Street and contains 50,280 sq. ft. of floor space. It is laid out with the most modern storage arrangements and will carry a complete stock of pipe, valves and fittings for the convenience of the Company's customers in that territory.

•

Duncan Bay Newsprint Mill Started.—The Elk Falls Company Limited reports that their new paper mill, construction of which started in the spring of 1951 has already gone into operation.

The company which is a jointly-owned subsidiary of the Canadian Western Lumber Company and Pacific Mills Limited plan for a complete utilization of raw materials from their forest operations and the new plant comprises a wood mill, equipped with a log-haul, cut-off saw, hydraulic barker, slasher saws and steam splitter.

The wood blocks being produced are conveyor-lifted to a water flume which carries them to the groundwood mill, which is fitted out with six Great Northern Waterous low-magazine grinders, driven by three 5500-hp. grinder motors, and screens, thickeners and washers. Continuous roll finishing is being done and the paper is being stored in a huge warehouse designed to handle 5000 tons. Paper stocks will be transferred from this warehouse to deep water terminal for shipment to markets throughout the world.

Designed for a production of 320 tons of newsprint paper per day, this mill will be the first newsprint mill to be built in British Columbia in 35 years and the first in Canada in 15 years.

•

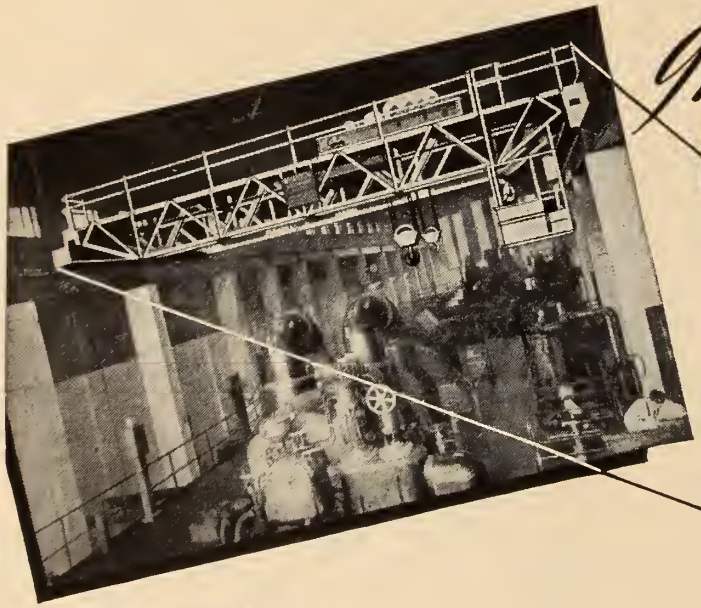
Dow Chemical Plastic Insulation.—Dow Chemical of Canada Limited reports that many companies are now using their light weight plastic foam material known as Styrofoam for insulating refrigerated trailers as well as for other applications to which it is well suited.

Styrofoam is very light in weight, besides which it has low thermal conductivity, long life, structural strength, high resistance to water vapour, mold and decomposition.

The material, produced by expanding polystyrene approximately 40 times, consists of tiny closed-wall cells which provide an excellent water vapour barrier. For this reason it was used during World War II as a buoyancy medium in life rafts and preservers.

Having a compressive strength of 20 pounds per square inch, as well as a high resistance to water vapour transmission it is particularly suitable for insulating trailer floors. Weighing not more than 2 pounds per cu. ft. and having good structural strength. Styrofoam can now be installed in large sections and is at the same time easy to handle, thus reducing labour costs.

•



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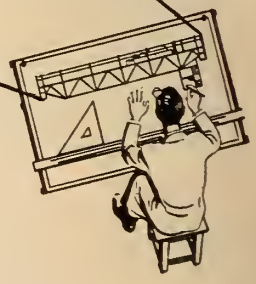

REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL, P.Q. (Walter M. Smith — President). MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. BRITISH COLUMBIA: Vancouver Engineering Works Ltd., 519 to 659 West Sixth Avenue, VANCOUVER, B.C.

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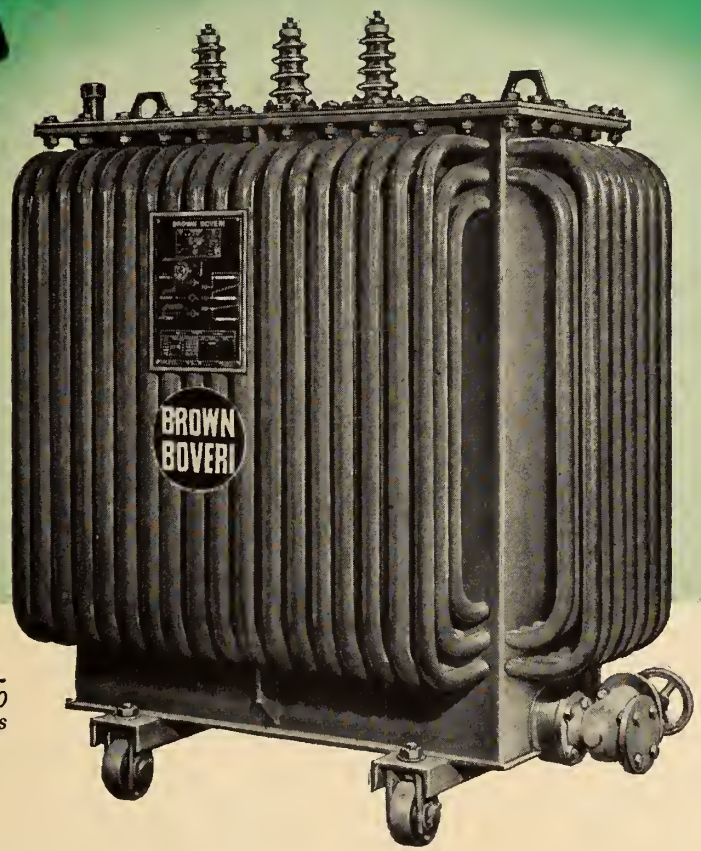

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NOTE:
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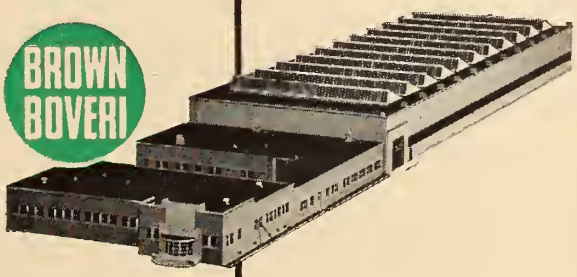

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Heated and Cooled Gauges.—Jerguson Gauge & Valve Company have issued a data sheet "Special function gauges and valves". The subject matter is "Jerguson heated and cooled gauges and valves." For copies write to Peacock Brothers Limited, Box 6070, Montreal, and ask for Jerguson Data Sheet on unit No. 179.

•

Shaper Operation. — South Bend Lathe Works, South Bend 22, Indiana, have issued a new handbook "How to Run a Metal Working Shaper". A nominal charge of twenty-five cents is made for a single copy but vocational directors and school shop instructors may receive free sample copies on request. Address requests to the Company.

•

New Austenal Publication. — The Microcast Division of Austenal Laboratories, 5932 South Wentworth Avenue, Chicago 21, Illinois, has just published a sixteen page booklet, in full colour. "New Opportunities For The Creative Product and Design Engineer". The booklet outlines Austenal Laboratory's development of their Microcast process of precision investment casting from the first uses of the process in producing intricate dental appliances to today's thousands of applications in virtually every branch of industry.

For copies of the booklet write to Austenal Laboratories, Microcast Division, 224 East 39th Street, New York 16, New York.

•

Variable Transformers.—The Superior Electric Company of Bristol, Connecticut, announces the addition of Type 10 to its line of Powerstat variable transformers. To provide potential users of this new Powerstat with complete information, Bulletin P252 has been issued. For copies apply to the Company at the address given above.

•

New Caterpillar Scrapers.—Caterpillar Tractor Co., Peoria 8, Ill., has announced a pair of new scrapers for use with the Cat DW10 Tractor. With this choice, the equipment user can match his rig more closely to job requirements.

Write to any Caterpillar distributor for copies of bulletin describing this new equipment.

•

Terminals & Connectors.—A complete 16 page catalogue especially designed for users of heavy duty power terminals and connectors has been produced by Aircraft-Marine Products, Inc. The book describes the many varieties of A-MP solderless power terminals and connectors, together with tables to assist engineers and designers in terminal selection. Wire sizes accommodated by these terminals and connectors range from No. 16 to No. 4/0. Requests for copies of the catalogue will receive prompt attention if addressed to Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa.

•

Canada Wire Make New Aluminum Cable.—Canada Wire & Cable Co. Ltd., Postal Station "R", Toronto 17, are Canadian Agents for Messrs. Johnson & Phillips Ltd., of Britain. The Canada Wire & Cable Co. Ltd. is manufacturing this Aluminum Sheathed Cable by the Johnson & Phillips process under Canadian Patent No. 480897. An excellent publication covering this Aluminum Sheathed Cable is available. It is a 28 page booklet containing very valuable information. It is beautifully produced. To obtain copies write to the company at the address given above and ask for J & P Publication CD 22.

•

C-L-A Issue New Electrodes Price List. — Canadian Liquid Air Company Limited, 1111 Beaver Hall Hill, Montreal, have issued a new Electrodes Price List. To obtain copies write to the company

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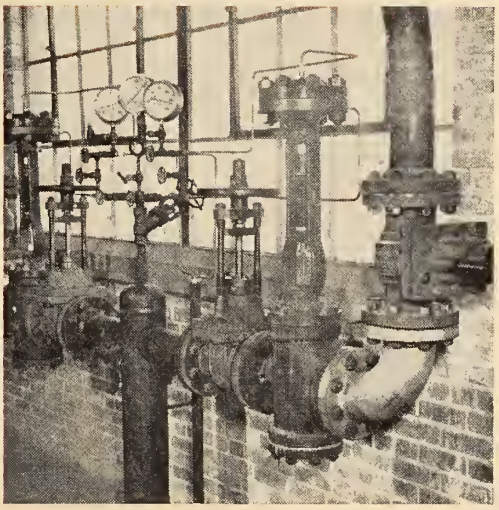
Standard material for all valves, discs and seats is Hopkinsons' own "Platnam"—the most satisfactory alloy so far developed for this purpose, having extreme resistance to erosion and corrosion.

Hopkinsons' valves are available in all pressure ranges up to 2,000 pounds per square inch steam and can be supplied for temperatures up to 1,000°F.

Hopkinsons' valves are unsurpassed for long life and hard-wearing toughness. They are made by the oldest and largest manufacturer of valves and boiler accessories in the world.



Three 6" Hopkinson steam stop valves in process steam lines in the boiler room of the Cornwall Division of Haward Smith Paper Mills Ltd.

PB51-5

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E.I.C. Technical Papers

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It is an obligation of the Institute to publish original works which contribute to the reference literature of the profession. The Technical Papers are distributed to the world's major engineering societies and technical libraries. Similarly it is an obligation of those engineers qualified to write these papers to submit them for possible inclusion in the literature. The publications committee invites authors to present such manuscripts for submission to qualified reviewers and publication if warranted. Written discussion will be accepted and published as supplements.

Technical papers issued to date are:—

No. 1—Flow in Conduits and Canals:—*French and Wood.* Comprises tables and diagrams for the solution of problems of flow in open and closed channels. Price $1.50

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This section of the *Journal* is intended to keep readers informed on developments and changes in those business and industrial enterprises, and on new products, which affect the engineer.

If you write with respect to any of the items in this, or other sections, please mention

THE ENGINEERING JOURNAL

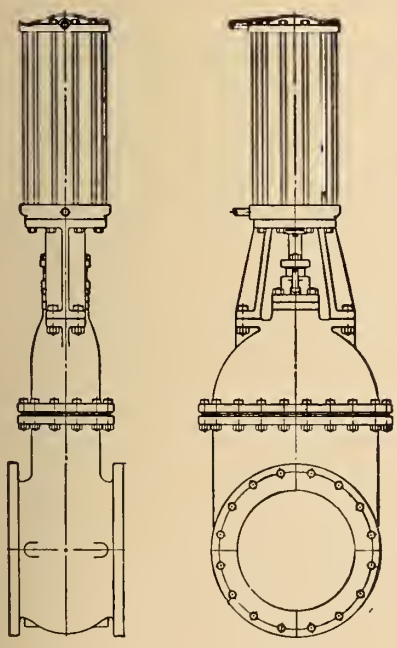

FIGURE 1060

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THE KOOTENAY LAKE SPAN

by

E. M. Stiles, M.E.I.C.

Chief Engineer

The Consolidated Mining and Smelting Company of Canada Limited.

A paper presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, B.C., May 7, 8 and 9, 1952.

This paper describes the two-mile overhead power transmission span constructed by the Dominion Bridge Company Limited, for The Consolidated Mining and Smelting Company of Canada Limited, across Kootenay Lake in southeastern British Columbia.

For some years The Consolidated Mining and Smelting Company of Canada Limited has been actively developing plans for a transmission line from its hydro plants on the Kootenay River, to supply power for its operations at Kimberley, B.C. The line was designed to carry 72,000 kva. at 161,000 volts. Construction commenced in the spring of 1951 and is now well advanced.

The distance by the shortest usable route is about 90 miles. However, this short line means spanning Kootenay Lake near its mid point. The lake is a body of water two miles wide, 475 feet deep and about 70 miles long. The alternative to crossing the lake was an extra 70 miles of line through extremely rugged country, at an additional expense of around one and a quarter million dollars. Furthermore, other things being equal, the carrying capacity of the 160-mile line would be about 30 percent less than that of the 90-mile line. Mathematically there is nothing wrong with a two-mile span; it is well within the theoretical distance according to the tables.

Our consulting engineers, Stone and Webster of Boston, and the Montreal Engineering Company, confirmed that the aerial span was entirely feasible, and preferable to an underwater crossing even if 170 kv. underwater cable were available. Its length, over two miles, exceeds by over 3,000 feet that of any span constructed to date, being in fact of the same order as a proposed crossing of the Straits of Messina.

Location

It is perhaps of more than passing interest to note that a reconnaissance survey for a line from the power plants to Kimberley was run in 1919. The route also involved crossing Kootenay Lake and at that time the lake span appeared too great, hence the scheme favoured was an underwater cable with transformers at both shore lines for stepping down and up again. All that remained to be done on the preliminaries was to prove that spanning the lake was good economics as well as a feasible engineering project. Good engineering and good economics are synonymous — otherwise there wouldn't be any money to pay for engineering.

Our estimates showed that the crossing would cost less than half as much as the extra 70 miles of line required to by-pass the lake. Furthermore, added snow-slide, lightning and forest-fire hazards on the long route seemed to more than offset any foreseeable risks due to the overhead span.

Careful reconnaissance was made to find the best combination of lake width to shore height. The location chosen north of Coffee Creek has a ground elevation on the west shore 1,280 feet above the water, and on the east shore, about 80 feet above water. Cominco surveyors, using the Geological Survey of Canada triangulation points and a 4,098 foot measured baseline, calculated the distance between proposed tower footings to be 10,655.92 feet. An independent check made the distance 10,655.77 feet, or an error of about 1 in 50,000.

E. M. Stiles, M.E.I.C. (left), the author, and W. G. Swan, M.E.I.C., chairman of the Annual Meeting session at which the paper "The Kootenay Lake Span" was presented.

Fig. 1. Method of positioning relieving cables prior to erection in order to assure distribution of stress to them after erection.

Fig. 2. East Tower—showing centre cable being hoisted into place with connection to insulator cage (note the relieving cables).

Design

The Dominion Bridge Company of Vancouver and Lachine were given the contract to design, fabricate and erect the crossing, and to their engineers credit is due for much of the technical data which follows. Structural and electrical features were checked by Cominco and West Kootenay Power and Light Company engineers and Cominco research men. Foundation conditions were appraised by Cominco geologists. As usual with such an undertaking, credit for it must be given to many people and many companies. whose names do not appear.

The design conditions are as follows: Power requirements 170,000 v., 72,000 kva. Minimum clearance of 120 feet above high water, a temperature range of from minus 20 deg. F. to 120 deg. F., and a loading of ½ in. of ice around the conductors, with 8 lb. wind pressure per square foot of projected area. Anchorages must have sufficient mass and be designed to resist twice the maximum computed uplift and shear. Anchorage steelwork to be designed for the maximum combination of loads at normal allowable unit stresses.

In order to assure of complete separation of the phases under any wind conditions, the west end of the span has three separate towers at 80 foot centres, while the east end consists of a single tower with the conductors spaced 35 feet apart. Minimum clearance above the lake required that the west towers should have an average height of 54 feet and the east tower 345 feet to the point of suspension. (Fig. 3). The west towers are set on rock so badly shattered that it was necessary to take care of tension anchorage with mass concrete. The east tower foundation is on gravel; backstays are carried to concrete anchors in the gravel hillside. This east tower is 366 feet overall height, 60 feet by 40 feet at the base, 40 feet by 10 feet at the top. The legs are 12 inch by 12 inch wide flange section at the bottom, and 10 in. by 10 in. at the top. All bracing is of two angles or channels, spread. The design of towers is to specification CSA-S16-1940. Allowable stresses are 20,000 lb. per sq. in. in tension, 16,000 lb. in compression. The weight of the east tower is 240 tons.

Conductors

The conductors are galvanized steel wire strands having the following characteristics:

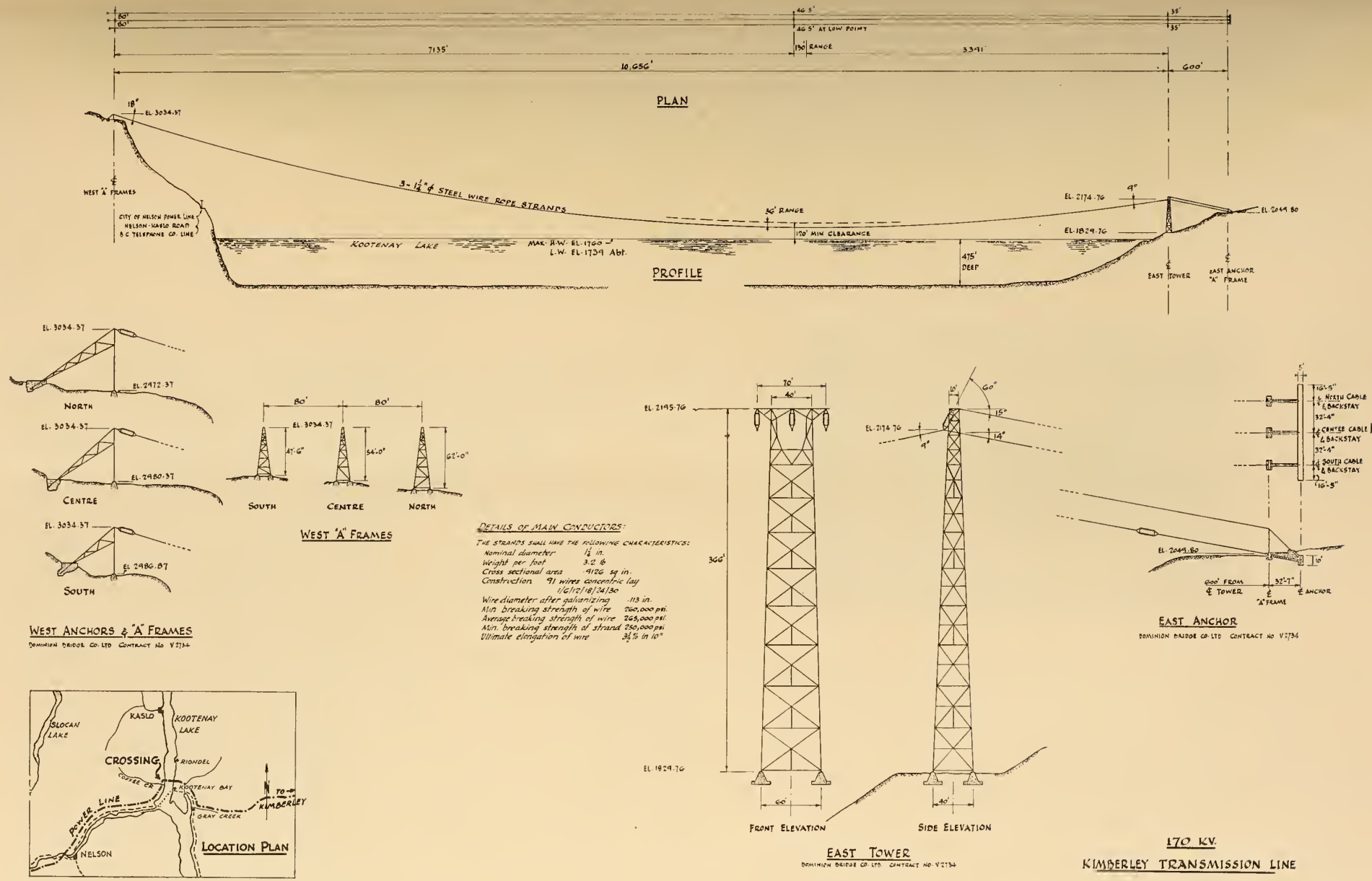

Fig. 3. General drawing of the Kootenay Lake Crossing.

Length	10,733 ft.
Nominal diameter .	1¼ in.
Weight per foot . .	3.2 lb.
Cross sectional area .	.9126 sq. in.
Construction. . . .	91 wires, concentric lay 30/24/18/12/6/1
Wire diameter . . .	.113 in. after galvanizing
Min. breaking strength.	Wire - 260,000 p.s.i. Strand - 250,000 p.s.i.
Ult. elongation. . .	Not less than 3½ percent in 10 in.

The strands are made up of hot-dipped galvanized wires, each wire being drawn full length from a separate billet without being welded or brazed at any stage of manufacture. Galvanizing to be capable of withstanding three standard one-minute immersion tests.

A free hanging cable assumes the catenary shape. For relatively flat curves, the catenary approaches the parabola very closely. For this span, the difference in length between these two curves is only 7 in. With this in mind, all calculations on the properties of the span were based on the assumed parabolic shape. The following figures were submitted in connection with the span:

1. Maximum cable tension occurs at minus 20 deg. F. with wind and ice. It amounts to 105,800 lbs. The resulting safety factor is 2.15.
2. Maximum stretch in the cable from minus 20 deg. F. and no ice to plus 32 deg. F. with ice, is 13.4 ft. The corresponding sag change is 38 ft.
3. Maximum sag in the design range occurs at plus 32 deg. F. with ice. It is about the same as would occur if the cable reached a temperature of 200 deg. F.
4. Without ice or wind, the factor of safety will range from 2.92 at minus 20 deg. F. to 3.04 at plus 120 deg. F.

Fig. 4. View of insulator cage with strings of insulators in place.

In an endeavour to reduce vibration at the supports, each end of each conductor is provided with two relieving cables of unequal lengths, approximately 95 feet and 105 feet long respectively. They are of the same size and construction as the main conductor strands and are attached to the latter by means of servings and suitable clamps. Each relieving cable carries 30 per cent of the tension, while the main cable carries 40 per cent. The arrangement is similar to one which has been in service for 25 years at Tacoma, Washington. Tests are now in progress to see if additional damping is required, either in the main span or the backstays. To prepare the cables to correct length it was

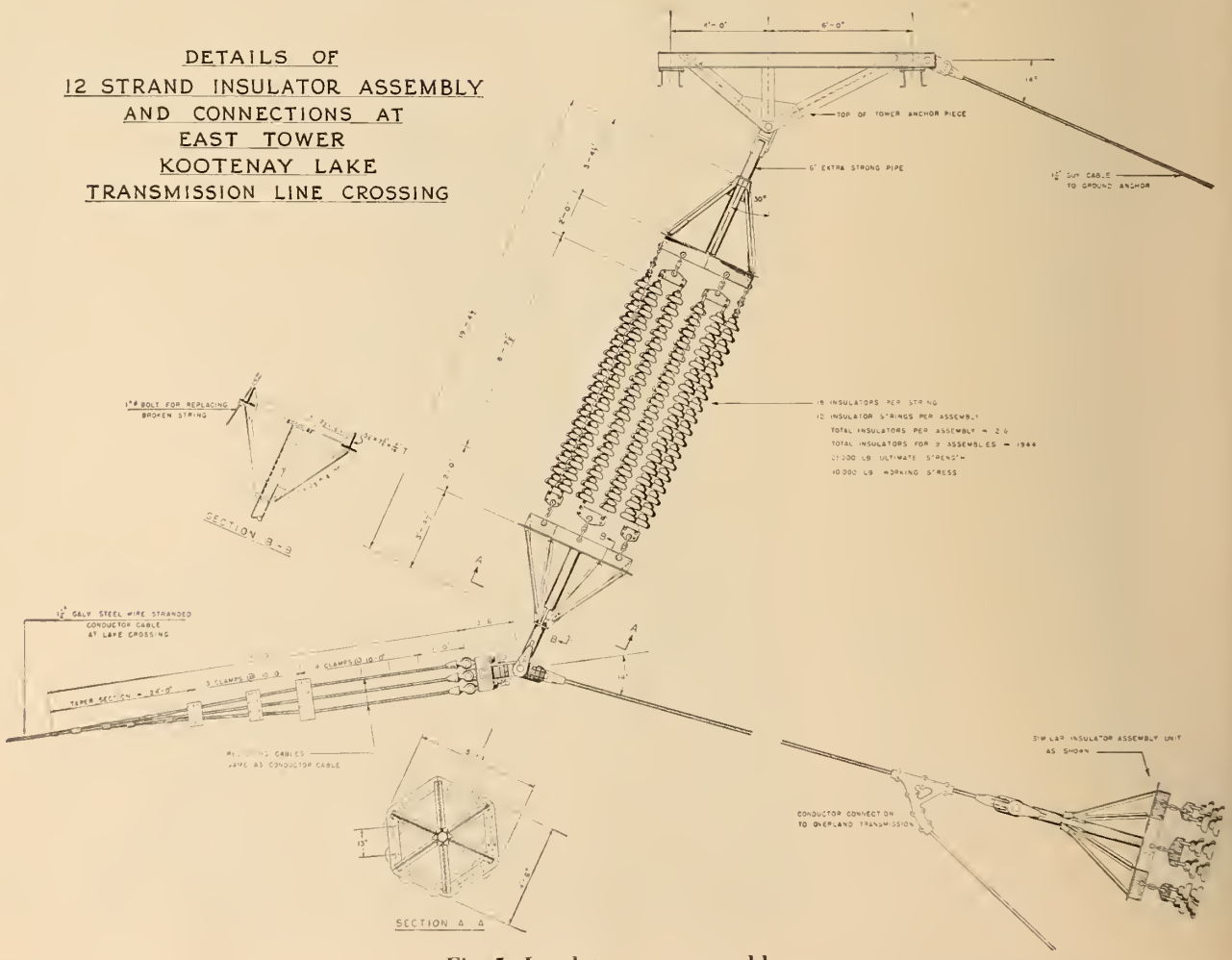

Fig. 5. Insulator cage assembly.

Table I

Amps.	Temp. Rise °C.	Cable Temp. °C.	Resistance Ohms/1000 ft. of Conductor	Reactance Ohms/1000 ft. of Conductor
300	47	69	0.148	0.160
250	32	54	0.134	0.159
200	20.5	42	0.126	0.156

necessary that they be prestressed. Since the maximum length that could be handled at the manufacturer's (John A. Roebling's Sons Company) prestressing plant is 3,600 feet, the cables were prestressed in three bites. They were held in powerful hydraulic clamps, zinc lined to prevent damage to the galvanizing. The cables were stressed to 115,000 lb. and held at that tension for 30 minutes, at the end of which period there was no appreciable creep. The pull was released and a 50,000 lb. pull reapplied, at which stage the length was carefully measured and marked. The cables were then reeled up and the ends socketed. Backstays and relieving cables underwent the same prestressing process.

Besides spanning the lake, the steel cables have to carry 72,000 kva. at 161 kv. The following tests were made last April by Professor G. A. Wallace, consulting electrical engineer, Montreal:—

> "The working length of the cable under test was 149.7 feet. The test length was supported in still air at a distance of about thirty inches from the floor, and was arranged as a straight single-phase two-conductor line, with a spacing of two feet centre to centre of conductors, and with the far end shorted, the cable being in the form of a long letter 'U'. The frequency of the current was sixty cycles. The temperatures were measured by thermocouple and were checked by thermometers. Results were obtained, as listed in Table I.
>
> "In each case, the readings were taken after the temperature had remained constant for at least one-half hour.
>
> "The temperature rise is almost exactly proportional to the square of the current over the range of currents used."

Three hundred amperes at 161,000 volts is equivalent to 83,500 kva.

Insulators

The conductor insulator assemblies and backstays are connected directly to the tower tops. In this arrangement, in case of breakage of one outside conductor, the east tower, 366 feet high, is sufficiently flexible to deflect and rotate under an unbalanced backstay pull without more than local buckling in the affected face of the tower. The separate west towers, 47 feet to 62 feet high, are subject only to a small deflection due to their relatively short backstays. Each insulator assembly is of the type proposed by the Canadian Ohio Brass Company, and consists of twelve strings of 18 insulators. (Fig. 5). Each string has a guaranteed minimum strength of 25,000 lb. The maximum working stress is 8,850 lb. per string.

The yokes and equalizer plates are provided with holes for the pull-up bolts to be used in replacing a broken string. Two sets of such pull-up bolts are provided, one for each side of the lake. At their ends, the yokes have two pins at right angles to each other, to permit free movement of the yokes in any direction should an insulator string break. All insulator assemblies and fittings are galvanized. All welds were magnafluxed.

While the towers will be painted in the international orange and white bands, the fact remains that the two-mile stretch between towers is difficult to mark. In the northwestern United States the Bonneville Power Administration has been wrestling with the problem of better delineation of its many river crossings and other long spans. Prof. H. J. Dana of Washington State College has developed a neon warning light which operates by magnetic induction from the transmission cables. Along with the light itself is a trolley to deliver it to any desired point in the span and retrieve it for replacement. When these units become available they will be used on the Kootenay Lake Crossing.

The cables for the crossing were erected between March 10 and March 28, 1952, by the Dominion Bridge Company, Vancouver, with a large cheering section of both local and long-distance visitors. It was a difficult job well carried out. √

Fig. 6. West Tower showing insulator cage in position to receive insulators.

The Engineer's Place in the Development of Canada's Natural Resources

by

The Honourable Robert H. Winters

Minister of Resources and Development of Canada, Ottawa.

An address delivered before the Montreal Branch of The Engineering Institute of Canada, March 13, 1952.

I recall the cool, sunny November day when my wife and I stood in Sydney with a young couple about to depart for Newfoundland. We had all been charmed by the simple graciousness of the woman, and the lively, enquiring interest of her husband as they moved among our people. This admirable young woman is now our Queen, Her Majesty, Queen Elizabeth II.

When the Duke of Edinburgh spoke to Canada from Halifax, he paid tribute to our people for what had been accomplished, by such a comparative few, in so large a land. Her Majesty also spoke of Canada's potential, envisioning not only the wealth of our vast material resources, but our increasing stature in the councils of free nations. These things, many of us had heard before, if we had not ourselves seen or felt them, but it added mightily to our ego to hear our opinions endorsed so completely by such personages.

I suppose there is no other single group of specially trained people that has been so long, so consistently and so closely associated with the growth of Canada from colonial days to the status of full-blown, free nationhood, as has the group of professional engineers. By its very nature, from the times of the early explorations, Canada has been a land that was both an invitation and a challenge to the engineer. As it was with the Romans, who built roads over which the legions marched to service areas within the expanded borders of an empire—so here in Canada, there was space to be conquered and a landscape to be adapted to human needs.

Transportation Facilities

First there were the canals. For nearly 1,000 miles, from the Strait of Belle Isle to Montreal, the Gulf and River St. Lawrence beckoned settlers inward from the open sea toward the heart of an unknown land, with great riches of forest, lake and river, apparent on every hand.

In this address the Minister of Resources and Development, himself an engineer, outlines past achievements of the Profession and visualizes a greatly expanded role for the engineer in the development of our nation's resources in the future.

Pointing out that Canadians themselves constitute the nation's greatest resource of all, he urges engineers to emerge from their technical cocoons and apply their talents and training to the solution of our social and moral problems, as well as those related to our material and economic well-being.

When natural obstacles appeared to block the way, the engineer built the means by which the forces of nature were directed to serve the needs of man.

Starting in the year 1700, when Dollier de Casson commenced to scrape, dig and cut a canal to provide a minimum of 18 inches of water below the laden keels of canoes and flat-bottomed bateaux travelling around the roaring Lachine Rapids, the Canadian canal system was developed, that now makes possible a 1,215-mile shipping route from Montreal to Fort William. Within that distance there are 75.92 miles of actual canal construction connecting navigable natural waterways, that climb 31 giant steps to overcome the 556-foot rise in level between Montreal and the waters above Sault Ste. Marie.

Similarly with Canadian railroading—from the start in 1835, of construction of the 16-mile line between Laprairie and St. Johns, Quebec, to the completion of the present trackage of nearly 58,000 miles, the story is one replete with great names in the profession, and great feats of engineering.

Exclusive of city streets and purely local roads, there are some 556,300 miles of roads, surfaced and non-surfaced, in Canada. This may not seem much, but when you think of it as approximately 70 yards of road for every man, woman and child, in the country, the figure takes on new proportions, specially if you should happen to view it from behind the business end of a snow shovel.

Because of the great natural obstacles of forest and rock, height and depth, gumbo and muskeg, winter frosts, shifting spring glaciers and heavy run-off—all these, added to the economic problems posed by sparse population across great distances, this half-a-million-miles represents a not inconsiderable job of Canadian engineering.

Airports

Between 1936 and 1939, a total of 30 selected sites, at approximately 100-mile intervals, were engineered into aerodromes or airports capable of serving two-engined transport aircraft landing at about 100 miles per hour and weighing 10 tons. It was necessary to pave one or two run-

ways about 3,000 feet long on each field, to light them for night flying, to provide radio range facilities for instrument flying and construct buildings and install equipment for operation. The whole route was built and put underway for about the cost of LaGuardia Airport in New York, and Trans-Canada Airlines commenced passenger - carrying flights on April 1st, 1939.

If this engineering accomplishment of less than four years duration is worthy of note, then I suggest that the development through the war years and since, can only be described as being spectacular. A total of 136 paved and lighted aerodromes are now in use in Canada. Among them are a number that have been engineered to accommodate the 150,000 pounds of loaded Stratocruiser that glides on or off the pavement at speeds approaching 150 miles per hour. The varying conditions found from tidewater to prairie, and from pockets in mountain fastnesses to the permafrost foundation of Sub-Arctic fields are subjects of continual study by our Canadian airport engineers.

Resources

Up to this point I have outlined, only in the sketchiest fashion, the development of the means of travel and transportation that served to "open up" the country. They were the basic "firsts" of progressive engineering in Canada. Hand-in-hand with them grew the many enterprises built upon the development of our natural resources—and the engineer was in the van of that development.

The field of agriculture is probably the most important of Canada's primary industries. It employs more than 25 per cent of the total gainfully occupied population. Here the engineer has contributed the know-how for design and operation, and for the constant improvement of mechanical equipment. The application of engineering training and knowledge toward producing the means to sow, cultivate, and harvest more acres, or tend and improve the quality of more herds of livestock and flocks of poultry, lies behind the reason Canada's 733,000 farms can produce enough food for our own people and still support a $900-million export trade with nearly 100 countries.

More important, however, is the work of the engineer in the irrigation, reclamation and rehabilitation programs designed to conserve the vital water tables, and maintain or enrich the fertility of the soil. The Federal Government, through implementation of the Prairie Farms Rehabilitation Act and the Maritime Marshlands Rehabilitation Act, has assisted with many projects. These range all the way from those sponsored by small organized groups of farmers requiring assistance on the local community level, to the gigantic St. Mary River Irrigation project in Alberta which, when completed, will bring water to some half a million acres of parched land. Canadian engineers have certainly been in the thick of efforts to provide more and better agricultural foodstuffs for the people of Canada and the world.

Commercial fishing is Canada's oldest primary industry. The market value of all products of our fisheries is placed at something better than $140 millions a year. Engineers have done much to improve gear and tackle and to provide safer, speedier transportation in the mechanized fleets. Greater catches of valuable food fish are the result. Latterly, research and experimentation in refrigeration and industrial processing is making good progress toward more complete utilization of this great natural resource. I have been in a position to watch this industry grow. Its development is an exciting story as far as it goes, but there is still much to be done.

With a population of less than one per cent of the world's total, we have in Canada over one-tenth of the world's known total installed capacity of hydro-electric power, yet this represents less than a quarter of Canada's known potential. Today's state of power shortage is due to the tremendous and sudden upsurge of our manufacturing industries and the attendant increased domestic needs.

The riches of Canada's mines, prepared in the crucible of nature, remained locked tightly as subterranean secrets until geological knowledge was applied. The storehouse has now been partially opened. It was the discovery of silver at Cobalt in 1903 that actually started Canada on the road to being a great mining country. The free-gold seekers of the great placer fields of the Cariboo, Kootenays and Klondike, had literally only been "scratching the surface".

Following the Cobalt find, a wave of exploration swept across the country, continuing to grow until it was virtually stopped, at full tide, by the depression of the 1930's. Then spurred by the sudden need for greatly increased quantities of strategic base metals during the second world war, the revival and expansion of Canada's mining industry has reached gratifying proportions. There is no need to elaborate here on the part played in this tremendous development by professional engineers.

Last year, Canada mined a record $1,228,000,000 worth of strategic and other minerals. Our mining industries output is comprised of at least 66 different mineral products, and among them are many of highly significant rating in both quantity and value. Canada ranks first in production of the world's nickel, asbestos and the platinum metals. She ranks second in aluminum, zinc, gold, cadmium, selenium, tellurium and, probably, radium and uranium. She ranks third in silver, and fourth in the production of lead, copper and cobalt.

Another development by scientists and engineers is the greatly increased output of oil as a result of the discovery of the Leduc field near Edmonton in February 1947, and of other producing fields since then. As a result, the oil position of Canada, and, perhaps the North American Continent, is being greatly changed. Of growing interest to oil prospectors is that great part of Canada north of the 60th parallel.

The story is similar when we turn to the mightiest enterprise in the land, the Pulp and Paper Industry, with its capital investments of more than $1,400 millions. The output of 131 pulp and paper mills during 1951 passed for the first time in our history the Billion Dollar annual production mark. Canada contributes about a third of the total world export of wood-pulp. We also produce more than half of the world's newsprint, and out of this total Canada handles about 80 per cent of the world's export trade in this commodity.

Engineering has been an integral part of forestry since the beginning, when it consisted mainly of the routing and building of skid roads over which logs were delivered to water. For too long engineering was heavily weighted on the exploitation side, but now, sound conservation and management practices are being developed and applied. The common goal of Government and industry today is management of our forests for sustained yield. The Federal Government has already signed with six provincial governments agreements designed to complete forest inventories and stimulate reforestation. The signing of others is imminent.

So far I have merely touched upon

the present development and economic significance of our primary natural resources. I will not take the time to remind you of the details of the many manufacturing processes, which, when added to the value of our primary production, help to make up a gross national product of some $21 billion. The role of the engineer is completely integrated with the whole pattern of development and utilization. It would not be amiss to say that these accomplishments are due, in large measure, to engineering genius for bridging the gap between the scientists' discoveries and our citizens' material needs.

Engineering Faces Broader Future

The story of Canadian engineering achievement up to now may be likened to a prologue, the play is just beginning. New canals are planned, railways are being built, roads are being improved and extended, the network of airways is spreading beyond all previously considered limits of distance and conditions. Agriculture, fisheries, water-power, mining and forestry are all facing new expansion. Some of them, notably mining and water-power, will be marked by new developments that will surpass anything seen so far. Every part of our country will feel the upsurge of the new growth. In the more remote regions of inland wilderness and far northern reaches, the growth may well be spectacular.

When the major projects of aluminum, iron ore and petroleum are carried through; when the St. Lawrence Seaway, the Canso Causeway, the Trans-Canada Highway, the reclamation and irrigation projects on our prairies and in the Maritimes, and many other important projects that will become necessary within the next fifteen years are completed; then, in a meeting such as this, we may look back and review what will be an even more impressive picture of the role of the engineer in the development of Canada's natural resources.

If what I have said so far seems to emphasize any one type of classification of engineering more than any other it is only because of the nature of my subject matter. My own reticence as an electronics engineer prevents me from dwelling upon the amazing development of electronics in the past generation and their contribution to Canada's economic growth. The electronic engineer in the last quarter-century has but removed one small corner of the veil from the picture of what will be done by the physicist-engineer during the next quarter century through the harnessing of atomic energy.

The role of the engineer is, in short, anything we engineers want to make it. I wonder if therein doesn't lie the greatest challenge to the profession. The field has been so vastly widened by specialization, particularly in manufacturing industries and business, that the opportunities greatly outnumber the engineers available. Our Minister of Labour, and Dr. Wright, the general secretary of the Institute, have both stated that Canada needs 2,000 young engineers to fill waiting positions. There is great responsibility imposed by this demand; we engineers have it in our hands to shape our own course, but we must know what that course is to be, before we can steer it.

It was not so long ago that the engineer was a pretty much stylized individual. He wore breeches and high boots even on the college campus, and his badges of office were the T-square over his shoulder and the slide-rule in his hip-pocket. He liked to view himself as a specialist, and he tended to deal with a very narrow field of activity. Naturally, that is the way the public came to regard him.

As time went on, the pattern changed; Canada developed, and as the frontiers were moved back the engineer often found himself a key figure in new municipalities. He was required to assume broader and heavier responsibilities. Good engineering colleges realized this trend and added to their curricula subjects designed to broaden the educational base of the engineer. He was required to take more English, to study literature, to learn accounting and business practices, and to do some public speaking. But we engineers, in many ways, are a conservative lot. We often subconsciously resist these developments; consider them unnecessary "frills" and, accordingly, individually and through associations, we have in many instances been our own worst enemies.

I believe that engineering is the best training any man, or for that matter any woman, can take. The technical side of it is precise, and if pursued any reasonable distance, especially in the field of research, it is one of the best of all mental developers. When this is rounded out with a little background in the general arts, it provides a solid base from which to launch a successful career. There is no reason why anybody, with a mentality sufficiently well developed and alert to weather successfully the rigours of college training in engineering cannot, with equal success, apply his knowledge to virtually any other problem that confronts him, no matter in what field it happens to occur.

Engineers Can Solve Other Problems

We engineers know this and yet, time after time, when a good administrative or executive position has been begging for qualified occupancy, we have been guilty of saying, and permitting other people to say, that as a matter of principle a lawyer, or accountant or other commercially-trained person is the type needed for the job.

I cannot be convinced that engineers have ever lacked confidence, but as a group, have we not allowed ourselves to be led into the belief that it is not, perhaps, in keeping with our profession, perhaps not dignified to tread off the narrow, restricted technical path? That is a great mistake, and any association which tries to set up barriers to prevent the free interchange between engineers and non-engineers with respect to any job, is doing the engineering profession a great disservice.

There are many people going about our land raising questions. Too few are suggesting constructive answers. I have recounted some of the figures that attest to the material strength of Canada. We know how well off we are in terms of things, but people are more important than things. It is well for us to remember that Canadians are the greatest resource of Canada.

Problems are a by-product of the day-to-day activities of normal human beings, and engineers are specialists in solving problems. The riddles of living give way to the same clarity of thinking, the same searching analysis, the same honest measuring of opposing factors and the same unselfish desire to find and use the right solution, as do the problems created by natural forces not yet brought into line for the benefit of man. We should be poorly fortified indeed, if, while rearming militarily, to build up the strength that will deter the enemy from committing acts of military aggression against us, we do not give as much of ourselves to the solving of our basic problems.

I am suggesting that the role of the engineer is not complete until the special skills of the profession are being applied to the utmost for the solution of our social and moral as well as our material and economic

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Engineering Problems Related to Alberta Natural Gas

by

Dr. George W. Govier

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

This paper deals with certain engineering and economic aspects of the development and marketing of natural gas. Explaining the nature and content of various gases and the types of markets they serve, the author describes how reserves are estimated and how deliverability is computed. Referring briefly to methods of processing for removal of by-products, he outlines the general principles governing pipeline design and shows how cost of transportation is determined.

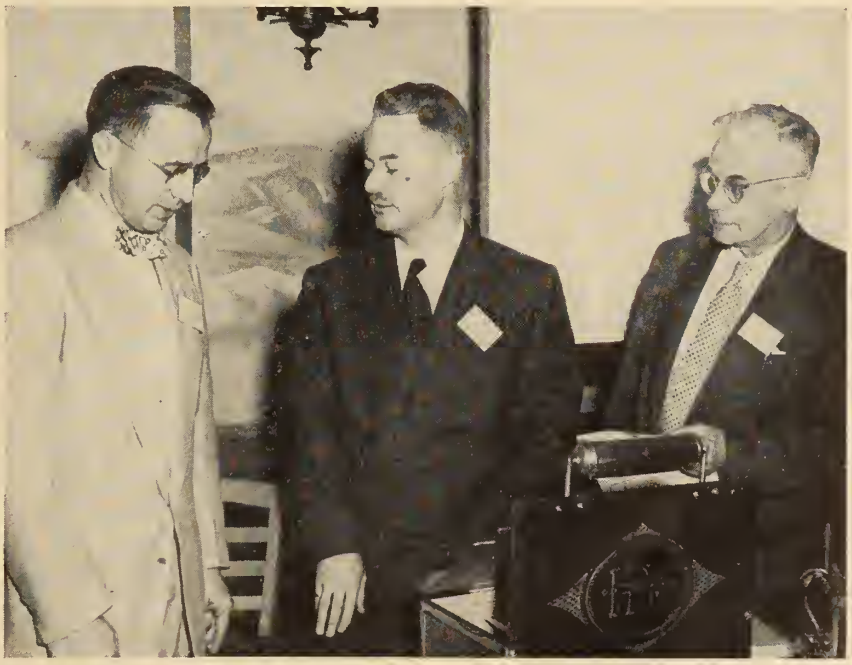
Natural gas is a mixture of normal paraffinic hydrocarbons often contaminated with water vapour, nitrogen, hydrogen sulphide and carbon dioxide. Its composition is variable over wide limits depending upon the source. Always containing methane, it may contain ethane, propane, butanes and pentanes in individual amounts ranging from 0.1, or less, of one per cent to 20 or more per cent—the lighter components always being present in the greater amounts. Nitrogen content commonly in the range of 3-5 per cent may vary from practically zero to 10 or so per cent. Hydrogen sulphide and carbon dioxide may be absent, or one or both of these components may be present in amounts commonly up to 5 per cent—rarely to 20 or more per cent.

A useful distinction is made between dry gas and wet gas. Dry gas is any natural gas not containing economically recoverable amounts of the higher hydrocarbons propane, butanes and pentanes. A wet gas, on the other hand, is one from which these higher components may economically be recovered. Gases are also commonly characterized as sweet or sour; a sour gas being one containing more than 10-20 grains of hydrogen sulphide per cubic foot.

Natural gas may be found dissolved in oil in the underground formation, it may be found in contact with but overlying oil in the formation, and it may also be found by itself not in any way associated with oil. Generally speaking, gas associated with oil is wet—that not so associated is dry or comparatively so. An exception is the gas of a so-called condensate field which is a field, like Pincher Creek or Jumping Pound, from which a condensate or light oil may be recovered upon pressure reduction even though the fluid in the reservoir is in a single phase. Gases from such reservoirs tend to be wet, frequently containing economically recoverable amounts of propane, butanes and pentanes in addition to the condensate.

Often, and particularly in the case of wet or sour gas, it is necessary and desirable to process a natural gas before it leaves the field. This processing may be required for one or both of two reasons. It may be necessary to make the gas transportable and merchantable, or processing may be desirable to obtain the higher hydrocarbon and other components which may be economically recoverable. The latter reason, viz. for the recovery of by-products, is of special importance today in view of the increasing demand for ethane, propane and butanes as raw materials for the petrochemical industry.

Natural gas, after any necessary processing, finds use as a domestic and commercial fuel, and as both fuel and raw material in industry. The domestic and commercial fuel



Left to right: J. E. Harris of Sarnia, Ont., Dr. G. W. Govier, the author, and A. E. Flynn, M.E.I.C., the chairman of the Annual Meeting session at which Dr. Govier's paper was presented.

markets have much in common and in both the requirements are extremely sensitive to weather. In fact the important space heating component of these two markets is almost mathematically related to the number of degrees and the number of days the temperature falls below 65 degrees Fahrenheit. Accordingly, the average market requirement may be significantly less than the peak day or winter requirement. The ratio of these quantities, average requirement to peak day requirement, is termed the load factor, and superficially characterizes the sinusoidal curve of requirement vs. time. Domestic and commercial load factors are generally low, ranging in Alberta from 30 to 35 per cent.

Since all facilities from the wells themselves to the burner tip must be designed to handle peak loads, the great significance of load factor is that it measures the effectiveness of average use of facilities. A load factor of 33 per cent, which is not uncommon for domestic markets, means that on the average all physical facilities involved are used only to 33 per cent capacity. This means high unit costs. The importance of the load factor to the large consumer is reflected in common rate schedules which incorporate both a commodity charge based upon volume used and a demand charge based upon peak day requirement.

The industrial fuel gas market, while slightly sensitive to weather, is generally characterized by a much higher load factor—often 90 per cent or better. In fact in some cases an industrial consumer may have provision to burn alternate fuel on days of greatest domestic and commercial load. Thus through interruption of his service the effect of a low domestic load factor can be partially offset to the benefit of all consumers.

In any case, a composite market of domestic, commercial and industrial load may, depending upon weather, distribution of load, interruption of industrial load, or use of storage facilities, be characterized by a load factor anywhere between 40 and nearly 100 per cent. Present overall load factors in Calgary and Edmonton are 40 per cent and 37 per cent. The completion of the Canadian Chemical Company plant in Edmonton next year will raise the overall load factor of that area to 45 per cent.

Between the discovery of natural gas through the drilling of a successful well and the delivery of fuel gas to a burner tip or of a butane stream to a petrochemical industry, there are many problems to be solved and, usually, much money to be spent. A single day's production cannot establish the productive potential of a well, nor can a single well define a field. In the development and marketing of a gas discovery there are risks to be taken —risks which require the most careful engineering and economic assessment in the light of the expenditures required and the responsibilities assumed if the gas is to be marketed.

The size and life of the reserve and the productive rates possible must be such as to make a venture economic, having regard to the necessary expenditures and the unit revenue from the sale of gas and by-products. While there are countless matters for engineering and economic assessment there are four of special import. These are the questions which relate to the Magnitude of the Reserves; the Delivery Characteristics of the Field; the Problems of Processing; and the Transmission of the Gas. I should like to highlight some of the engineering aspects of these topics.

Magnitude of the Reserves

The magnitude of the natural gas reserves is without doubt the most significant of all the factors which relate to the overall long term economics of the development and marketing of natural gas. Unfortunately this controlling factor is one which cannot be estimated with reliance until at least some step-out drilling has followed an initial strike. With the aid of seismic information and geological interpretations, however, a preliminary assessment of minimum reserves can be made on the basis of a single well. This must suffice to determine whether or not follow-up drilling is justifiable.

Gas in the reservoir is contained in the pore spaces of porous permeable sandstones and limestones. Reserves may be calculated by the so-called volumetric method, from a knowledge of the areal extent, thickness and porosity of the gas saturated rock, coupled with measurements of the gas pressure and temperature. A complicating factor is the variation in thickness and porosity of the gas saturated rock over its areal extent. Also serious is the infinitesimal sampling percentage afforded by a 4 inch diameter core per square mile. (One well per square mile is common spacing with gas wells.) Areal extent, pay thickness and porosity can only be determined for certainty by drilling wells virtually to outline the field with dry holes.

In practice, seismic data and geological interpretations aid materially in arriving at satisfactory estimates of area and thickness after the drilling of a few key wells. In the case of the famous Pincher Creek field in southwestern Alberta a reasonably reliable estimate of reserves is now believed possible after the drilling of only four wells out of a total of about 24 locations. Here, however, the seismic data have correlated exceptionally well with the results of drilling. In general, initial reserves of gas fields are in the range of ¼ to 1 million cubic feet for each acre-foot of gross reservoir space—the variance being due mostly to pressure and porosity.

All of the "gas in place" in a reservoir cannot be produced at economical rates. Accordingly a discount for "reservoir loss" must be applied to take care of gas which will be left in the reservoir at abandonment conditions. This discount is of the order of 10 per cent under normal conditions but may run considerably higher. It may reach 15, 20 or 25 per cent in cases of thin sands, active underlying water or where other reservoir conditions might cause premature abandonment.

Field uses and losses cause a further reduction of anywhere from 5 to 25 or more per cent from the gas produced. Field uses may include lease fuel, drilling fuel, production or line heater fuel, compressor fuel and processing plant fuel. Operational losses result most frequently from well testing and blowing wells to clear water. While not strictly a loss, the processing "shrinkage" attending the removal of water vapour, hydrogen sulphide, carbon dioxide, and any of the higher hydrocarbons results in a volume reduction which may reach as high as 15-20 per cent. All of these factors are commonly grouped together under the heading of a surface discount applicable to the gross gas production.

Thus, to assess the amount of gas which may be considered disposable or available for sale requires the estimation by volumetric methods of the amount of gas in place in the reservoir, the discounting of this for reservoir loss, and the further discounting of the producible gas for applicable surface losses. The final figure multiplied by an estimated field price, now hovering in the range of 8-10-12c per 1,000 cubic feet, indicates the gross revenue ob-

tainable from a dry, sweet gas. For wet gases, and in some cases sour gases, an additional and often substantial revenue may be available from the recovery and sale of by-products.

Delivery Characteristics of the Field

Closely related to the question of reserves is the matter of field deliverability, or the rate at which the gas may be produced. This rate depends upon the number of producing wells and the individual well delivery characteristics. The maximum number of wells which may be drilled in a given field is normally controlled either by governmental spacing restrictions or more commonly by the economic restrictions imposed by the size of the reserve and the gross revenue obtainable.

Close spacing of wells will not significantly increase the amount of gas recovered, but will only permit its more rapid production. Generally it is found that the economic range is one well to every 1-1½ to 2 sections. Thus the common legal spacing pattern of 1 well per section usually corresponds with maximum drilling density. Exceptions to this are found in the case of very shallow sands for which both the economics and the legal restrictions may be different.

With respect to the individual well delivery characteristics, gas reservoir pressure and thickness and permeability of the reservoir rock are the controlling factors. When a gas well is being produced a radial pressure gradient in the direction of the well bore is established in the reservoir. It may be shown theoretically that the rate of gas influx to the well bore is nearly proportional to the difference between the squares of the pressure in distant parts of the reservoir and that at the well bore itself.

A well testing procedure based upon this theory permits the determination of the equation constants, and thus enables the prediction of well production rates for any set of reservoir and sand face pressures. The theoretical maximum production (which would correspond with the maximum difference in the squared pressures) would occur if the sand face pressure were brought to zero by removing all back pressure and resistance to flow downstream from the sand face.

This theoretical rate is known as the absolute open flow of the well, and may be deduced from the results of a field test. The absolute open flow is a good theoretical characterizing factor, but it is not a direct measure of a well's deliverability under good engineering practice. Experience has shown that gas wells must be produced at rates considerably below the absolute open flow if well damage and reservoir damage with loss of gas recovery are to be avoided. Practice on this continent is to produce at rates in the range of 20-30 per cent of absolute open flow.

An important characteristic of well deliverability is its dependence upon reservoir pressure. The absolute open flow declines almost with the square of the reservoir pressure. For this reason well deliverability falls off as production is taken from a field and as the average reservoir pressure declines. While the absolute open flow declines at a faster than linear rate, good engineering practice does permit a gradual increase in the percentage of open flow. Thus actual per well delivery rates may often be considered to decline linearly, with production from 25 per cent of virgin absolute open flow, to nearly zero at abandonment condition. Until a field has been drilled to its economic drilling density the declining individual well deliverability may be offset through the drilling of further wells. Thereafter delivery capacity of the field declines approximately linearly with production.

Fully developed reserves generally yield maximum delivery capacities in the range of 250-400 million cubic feet per day for each trillion cubic feet of remaining marketable reserve. Strangely enough the large foothills reserves of Alberta, Pincher Creek and Jumping Pound, are at the low end of this scale and the shallower plains fields yield the larger deliverability per unit of reserve. This is due chiefly to the fact that the high pressure foothills reserves do not provide proportionately as many economical drilling sites.

Problems of Natural Gas Processing

In most instances, natural gas as produced from wells requires some processing. If it is dry and sweet, as is often the case, the gas may only require processing for the removal of water vapour. This, if not removed, could cause difficulties through corrosion, ice formation or gas hydrate formation in the transmission and ultimate distribution lines. If the gas contains hydrogen sulphide this must be removed, to render the gas non-corrosive for transportation purposes, and to reduce its toxicity and render it merchantable. If the gas is wet in the sense that it contains the higher hydrocarbons, especially propane and butanes, these hydrocarbons must be removed, not only because they are valuable by-products, but also to minimize gas hydrate problems in transmission.

Gases containing hydrogen sulphide are usually first processed for the removal of this component. The most common process is the Girbotol, in which the sour gas is contacted in a bubble cap and tray absorber with an aqueous solution, usually of monoethanolamine. The alkaline amine solution absorbs the acidic hydrogen sulphide, as well as carbon dioxide if present, producing a sweet or scrubbed gas. The amine solution is regenerated by application of heat, which drives off the previously absorbed hydrogen sulphide.

The present demand for sulphur, together with improvements in sulphur recovery processes, has made economically attractive the further treatment of the effluent hydrogen sulphide for the recovery of elemental sulphur. Thus at Jumping Pound and at Turner Valley elemental sulphur is now being recovered from the effluent gas leaving the amine regenerator. Costs of hydrogen sulphide removal vary considerably with the scale, load factor and pressure of operation, the concentration of the acid gases, and the recovery or otherwise of sulphur.

Water vapour removal may also be carried out through an absorption process, in which the sweet gas is contacted in a tray absorber by a water absorbing solution—diethylene glycol being commonly used. By control of solution concentration and degree of contact, the water vapour concentration may be reduced to any desired degree. The glycol solution is regenerated by application of heat and the expulsion of the absorbed water vapour.

An alternate and competitive dehydration process involves passing the gas downward through a bed of granules or pellets of solid dessicant. Activated bauxite and alumina are commonly employed for this purpose. Regeneration of the dessicant is necessary every 8 to 12 hours. This is accomplished by the diversion of the main stream of gas through a second drying bed, and by the routing of a small stream of heated gas through the saturated bed. Cost of dehydration, like that of acid gas removal, depends greatly upon the scale, load factor, and pressure of operation, as well as upon the dew point specifi-

cation to be met. Figures range from 0.1 to 3 or 4 mills per 1000 cubic feet of gas processed.

Two processes are in widespread use for the removal and recovery of natural gasoline, butanes, propane and to some extent ethane. Most common is the oil absorption process. Operating at pressures anywhere from 50 to 1,200 p.s.i., this process employs a light oil as an absorbing medium for the hydrocarbons to be recovered. In this process the wet gas is contacted with the oil, the desired hydrocarbons are absorbed and a dry residue gas is produced. The oil with its absorbed material is subjected to distillation at reduced pressure and elevated temperature to drive out the dissolved hydrocarbons, which are subsequently recovered and purified through fractional distillation.

A second process involves the recovery of the desired hydrocarbons by low temperature fractionation. Here the wet feed gas is cooled and partially liquified by refrigeration, and introduced into a refrigerated fractionation system permitting the direct removal and recovery of the higher hydrocarbons.

The natural gasoline, butanes, propane and ethane which may result from the processing of a wet gas include valuable feed stocks for gasoline blending, aviation gasoline manufacture, synthetic rubber manufacture, and for the great variety of new petrochemical industries, including synthetic fibres and plastics. Propane also finds a ready, although poor load factor market, as bottled gas for suburban and rural domestic and commercial fuel. Depending upon the degree of "wetness" of the raw gas the revenue from the sale of by-products may range from only a small credit towards the cost of processing to an amount comparable with that from the residue gas itself.

The gas resulting from the necessary processing is the portion of the raw natural gas available for fuel gas purposes. It may be considered to be methane diluted with small amounts of nitrogen, and containing small amounts of ethane and perhaps propane. The gas is sweet, non-corrosive, of constant heating value ranging from 900 to over 1,000 B.t.u. per cubic foot, and readily transportable by pipeline.

Transmission of the Gas

Technical problems in the pipeline transportation of natural gas are encountered both during design and construction. Not being a construction man, I shall refer only to a few matters of design. The chief design problems are those dealing with the carrying capacity of the line. Design for mechanical strength, mechanical protection and corrosion resistance introduce few complications. At the operating pressures commonly used in long distance lines, high strength steels of over 50,000 p.s.i. minimum yield point are found the most economical.

Design for adequate flow capacity involves a complex economic balance to fix three of the four quantities: operating pressure, line diameter, compressor station spacing and compression ratio. (The compression ratio determines the allowable pressure drop over the distance between compressor stations.) The range of optimum designs often results in operating pressures of 750-1,000 p.s.i., compressor stations being spaced some 60 to 80 miles apart, and operation at compression ratios of 1.3 to 1.6.

For a given upstream pressure, a fixed spacing of compressor stations, and a specified compression ratio, the necessary line diameter may be computed with considerable accuracy from the equations describing the flow of compressible fluids. With the high operating pressures, corrections must be made for deviation from ideal gas behaviour, and for changes in elevation, such as would be encountered in a line from Alberta to British Columbia. It is important to note that the line and all auxiliaries must be designed for the peak day volume—thus for twice its average throughput if the load factor is 50 per cent.

The major factors in determining the unit cost of transporting gas by long distance pipeline are the distance, the annual volume to be handled and the load factor. Nature of terrain is also of importance, since one mile of pipeline in difficult terrain may cost as much as many miles in "good pipeline country". Over a long line on a carefully chosen route however, a number of miles of difficult construction may be absorbed without greatly altering the overall economics.

Other factors being equal, transportation costs per 1,000 cubic feet vary directly with distance and almost inversely with load factor. The great importance of load factor makes it to the interest of the producer, the transporter, and the consumer to use every device to increase the effective load factor of the line. Thus, interruptible industrial load and market-end storage can materially influence average transportation costs. It is difficult to do more than generalize concerning the exact influence of the scale of operation or annual volume. Certainly the minimum economical scale of operation is greatly dependent upon distance.

The final answer as to the minimum volume which can be transported a given distance economically may be obtained only through a complete cost study. It calls for a comparison of unit transportation cost with the margin between the competitive selling price at the market end of the line and the field price at the other end. Generally it does seem to work out that present day transportation costs for economical long distance lines lie in the range of over 1c but under 3c per 1,000 cubic feet moved 100 miles.

Conclusions

I have tried to touch upon some of the engineering and economic aspects of the development and marketing of natural gas. While I have tried to keep my comments general, I have of course been thinking of Alberta gas, while you have been thinking of the Pacific Coast market. As stated at the outset, I do not wish to discuss specific questions of export. One matter I will refer to, however, because I understand there is some confusion concerning it. It has been said that the export permit to be issued to the Westcoast Transmission Companies, upon their compliance with certain conditions, is for 210 billion cubic feet. I have also heard it said that no line could be financed upon such a volume.

The figure of 210 billion cubic feet, removed from the context of the proposed permit, is incomplete and misleading. The proposed permit is for a period of 22 years from its date of issue. During the first 5 years of actual export the maximum amount of gas to be withdrawn from the Province of Alberta by the Westcoast Transmission Companies is 210 billion cubic feet. During the remaining years of the permit, the amounts to be withdrawn are to be those as fixed by the Petroleum and Natural Gas Conservation Board, in accordance with the Gas Resources Preservation Act.

I personally do not know whether or not the line can be financed—that is Westcoast Transmission's business. I do know that we in Alberta—even the Conservation Board which is sometimes considered to be conservative—are confident in our expectations of further and substantial increases in

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Recent Developments in the use of Concrete and Reinforced Concrete

by

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A paper presented to the Kingston Branch of The Engineering Institute of Canada, March 27, 1951.

To engineers not closely in touch with concrete technology, reinforced concrete today seems much like that of 1920. Whilst some of today's reinforced concrete structures do not differ greatly from those of a previous era, many are radically different and the variety of structures that can be built economically of concrete or reinforced concrete is continually increasing. A good summary of our present knowledge and practice in all engineering fields, "written so you can understand it", ought to appear every few years. Professor S. D. Lash, Professor of Civil Engineering at Queen's University, does just that for reinforced concrete in this paper, which was originally presented before the Kingston Branch.

There have been many important developments in the making and use of Portland cement concrete during the past twenty years. Some, for example the use of air-entraining agents, are now generally accepted in constructional practice; others, such as the use of prestressed concrete, are common in some countries but not in Canada, and still others have not yet progressed beyond the laboratory. It is the purpose of this paper to review briefly some of the more important recent developments, including both those that are familiar and others little known in Canada.

This paper is partly based on information collected during a brief visit to Great Britain and to the Continent during the summer of 1950. In some ways technical practice is more advanced in Europe than in America and innovations in concrete practice have frequently originated in Europe. This is particularly true of France. In a material as widely used as concrete, technical development is not confined to any one country or continent. However, tradition on the one hand and greater nicety of design on the other, have helped to keep European countries in the lead in many aspects of reinforced concrete design.

Cement

Concrete is an artificial stone composed of cement, aggregate and water. Of these materials, cement is the most important, for the strength and durability of the concrete depend largely on its quality. It is also the most costly. Ordinary Portland cements are made from limestone and clay or similar materials. The properties of such cements can be modified by variations in the proportions of raw materials and the process of manufacture. Notable developments in this field include cements with low heats of hydration, developed in the United States for use in building large concrete dams, especially in hot climates; alkali-resisting cements developed in Canada for better resistance to ground water containing sulphates, and high early strength cements for use when concrete may be stressed at an early age.

Within the past five years, considerable interest has been shown in cements having properties similar to Portland cement, but manufactured from different raw materials. The most important of these cements are made from blast furnace slag. If suitable slags are available, such cements can be made more cheaply than Portland cement because no kiln is required. Blast furnace slag cements have properties similar to Portland cements, with a tendency to somewhat lower strengths but better resistance to sulphate waters. Portland blast furnace slag cements consist of mixtures of finely ground blast furnace slag and normal Portland cement clinker. In Germany, such cement is used more extensively than straight Portland cement. In Great Britain and the United States, blast furnace slag cement is used to a limited, but increasing, extent. The ultimate usefulness of this type of cement will, of course, be governed by general economic considerations and by the quantity of slag available, but this is considerable for recent tests have shown① that acceptable slags may be found in old slag heaps such as those at Sydney, N.S.

A special type of blast furnace slag cement known as "supersulphated metallurgical cement"② is manufactured in Belgium. This consists of about 85 per cent granulated blast furnace slag, with additions of calcium sulphate and small quantities of Portland cement or of slaked lime. It is claimed that concrete made with this cement is superior to ordinary concrete in many ways and particularly in respect to resistance to attack by sulphates. Canadian laboratories are testing this cement so that its properties may soon become better known. Another variation of blast furnace slag cement is "Trief cement"③ also made in Belgium. This cement is supplied to the user

Fig. 1. Bridge Pier at Newcastle, N.B., constructed of grouted-aggregate concrete. (Intrusion Pre-pakt Ltd.)

as a slurry and is activated by the addition of a small quantity of Portland cement. It is used principally by manufacturers of concrete products, but has also been used in mass concrete works such as dams.

Pozzolanic cements are by no means new, but there are indications that their use will be extended. A pozzolana is a material with little or no cementing properties by itself, but which, when mixed with cement, combines with the free lime produced when cement is hydrated. Pozzolana is usually employed as a replacement for part of the cement in the mix and the resulting concrete is frequently more durable than ordinary concrete. Suitable materials include diatomaceous earth, fly ash and other finely divided siliceous materials. Research in such materials has recently been reported both in Canada and in the United States.④⑤ The United States Bureau of Reclamation has specified pozzolanic cement for a number of dams.

A cement with unusual properties has been developed in France.⑥ Whereas concrete made with ordinary cements shrinks in a dry environment, concrete made with "expansive cement" expands and in doing so, can be made to exert considerable force. These forces have been utilized in arch construction and in underpinning, and it is suggested that they could be used in prestressed concrete for stressing the reinforcement. It is also proper at this point to mention air-entraining cements; these will be considered later under the subject of admixtures.

High-alumina cement was first developed in France many years ago. However, this type of cement has remained somewhat of a novelty here, largely owing to its high cost. Where great early strength is required, high alumina cement is unrivalled.

Fig. 2. Use of conveyor belts supported on Bailey bridges for distributing concrete. (Hydro-Electric Power Commission of Ontario)

Concrete Aggregate

Developments in concrete aggregates have been concerned principally with the manufacture of lightweight aggregates and the selection and grading of natural aggregates for high-strength concretes.

It has long been recognized that one of the disadvantages of concrete structures is their considerable dead weight. As the aggregate represents perhaps five-sixths of the total weight of concrete, a reduction in density of aggregate is necessary if the overall density of the concrete is to be reduced. The only alternative is to reduce the proportion of aggregate; for various reasons this is undesirable. The problem in making a lightweight concrete, therefore, is primarily that of finding an inexpensive and otherwise suitable lightweight aggregate. Some reduction of strength is to be anticipated with such an aggregate, but frequently this is not objectionable. The most satisfactory results so far obtained have come from the processing of blast furnace slag. Various patented methods are used, especially in the United States, for manufacturing expanded blast furnace slags. Simpler methods of granulating the slag are used in Great Britain and Europe. On the whole the American processes appear to be the more satisfactory. Expanded clay and shale aggregates are used extensively in the United States and less extensively in Canada. Aggregates of this type were used successfully in the construction of reinforced concrete boats during World War II. Recent studies by the Department of Mines and Technical Resources⑦ have indicated that suitable raw materials for lightweight aggregates are available in Canada.

The use of vermiculite as a concrete aggregate has grown rapidly

during the past few years and may be further stimulated by the recent discovery near Perth, Ont., of considerable deposits of suitable micas.(8) These micas, when expanded by heating, give an aggregate of very low density and the resulting concrete, although weak, is a useful material because of its low thermal conductivity.

Another method of making concrete of low density and also of low cost consists simply in omitting all fine aggregate. This concrete consists of particles of coarse aggregate stuck together with cement paste. "No fines concrete", as it is called, has been used extensively in Holland and in Great Britain in the construction of apartment houses and dwellings. It is, of course, porous and has to be protected by a surface skin of stucco. On the other hand, the absence of capillary passages and the free circulation of air means that damp does not readily penetrate through such a wall.

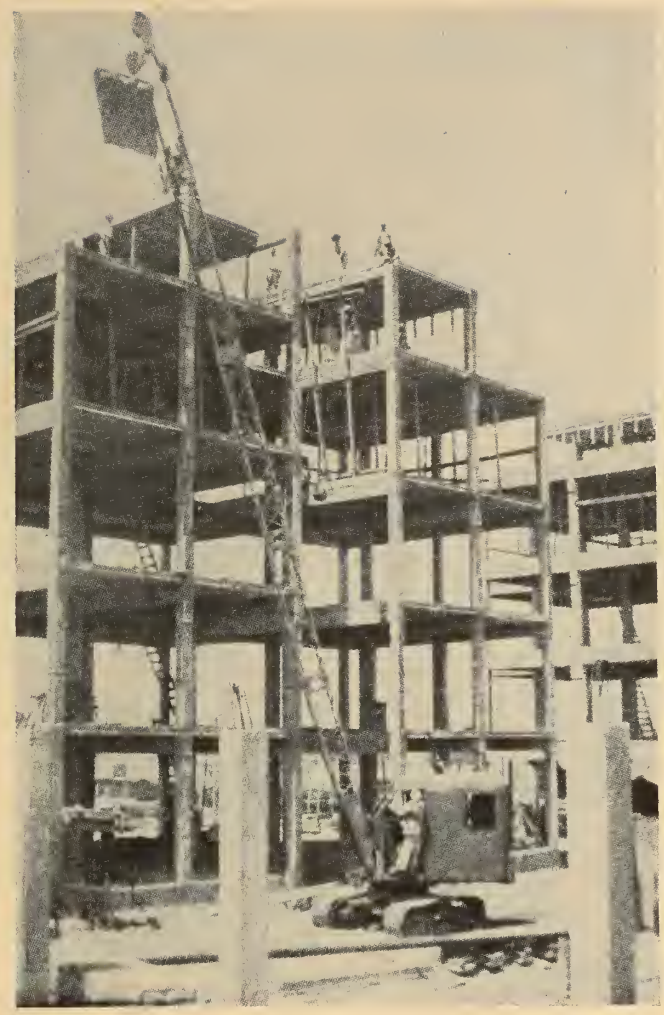

Fig. 3. Precast housing construction in Cairo, Egypt, using vacuum concrete columns, beams and floor slabs. (Vacuum Concrete. Inc.)

Admixtures

Ten years ago most concrete technicians had little use for admixtures. The general feeling was that good concrete could be made without them and that, on the other hand, admixtures would not compensate for deficiencies in concrete-making techniques. Today this attitude is considerably altered and it is recognized that admixtures *can* improve the properties of concrete. This is particularly true of air entraining agents.(9) Experiments in the United States during the 'thirties show that the addition of very small quantities of Vinsol resins to the mix result in air being trapped in the concrete and that the entrained air greatly improves its durability and also improves the workability of the wet concrete. Later investigators have shown that a considerable variety of materials can be used as air-entraining agents, including soapy materials and household detergents of the alkyl-lauryl sulphate type. Such air entraining agents are either mixed with cement at the mill or added to the mix by the user.

The use of air-entraining agents to improve the durability of concrete should not be confused with the use of gas-producing or foaming agents to make lightweight concrete, although the same materials may be used for both purposes. In air-entrained concrete, the amount of entrained air, and hence the reduction in density, seldom exceeds 5 per cent, whereas in lightweight concrete a reduction in density of at least 25 per cent is desirable. "Gas concrete", as it is sometimes called, was first developed in Sweden during the 'twenties, aluminum powder being used as the gas-producing agent. Considerable quantities of gas concrete are still used, especially in Scandinavian countries, and materials other than aluminum powder are sometimes used as gas-producing or foaming agents. These include foams of the type used in fire extinguishers and foams produced by detergents. The gas may be hydrogen, oxygen or air depending on the process used. With special curing conditions lime may be used to replace all or part of the Portland cement.

Mention should also be made of calcium chloride, which is extensively used, either alone or in association with other admixtures, as an accelerating agent. High-early-strength concretes can be produced most economically by the use of calcium chloride in amounts not exceeding 2 per cent by weight of the cement. The calcium chloride should preferably be dissolved in the mixing water.

Admixtures are also used as integral waterproofing and damp-proofing materials and to counteract alkali-aggregate reactions. The alkali aggregates are not common in Canada, but in the United States it has been found that certain aggregates will react with the free alkali in the cement and cause disintegration of the concrete.

High Strength Concretes

Recently, attention has been directed towards producing unusually strong concretes. Part of the stimulus for this has come from the practice and writings of the eminent French engineer, Eugène Freyssinet.

In 1938(10) he claimed that concrete made with Portland cement could be made to have a strength of 4,000 p.s.i. at 3 hours and 14,000 p.s.i. after a few weeks. These were cube strengths: they would have been lower had 6″ × 12″ cylinders been used. These high strengths were secured by (a) careful

Fig. 4. Precast concrete roof lights. (N. V. Schokbeton, Holland)

selection of aggregates, particularly with regard to grading, (b) consolidation by vibration and (c) the application of heat and pressure during the setting process. It has been pointed out recently by Collins⑪ that the problem of making high-strength concrete is that of consolidating mixes having low water-cement ratios and not too great cement contents. High-strength concrete can be usefully employed where reduction of dead weight is desirable, for example, in long-span bridges, in precast structural members or where stresses may be high, as in tunnel linings. Very-high-strength concrete is essentially a new material and it will doubtless be found to have many uses.

Mixing and Placing Concrete

Methods of mixing concrete have not changed substantially during the past twenty years though batch mixers have been improved. A vigorous educational campaign by the cement companies and others has helped to raise the standard of concrete-making technique, but there is still much room for improvement, except perhaps on the largest and most important jobs.

An important new development has been a method of making concrete by grouting aggregate previously placed and consolidated.⑫ This process, commercially known as "Intrusion Pre-pakt", has been used extensively for repairing and strengthening existing structures in Canada and in the United States. New structures have also been built in this way as shown in Figure 1. One advantage of this method is that concrete can be placed underwater without dewatering the forms. A further important feature is that comparatively high-strength concrete is obtained with a low cement content.

Continuous concrete mixers, as distinguished from batch mixers, have been used on the continent and in Great Britain.⑬

The ready-mixed concrete business, using either plant-mixed or transit-mixed concrete, has made a substantial contribution to concrete progress and in some Canadian cities more concrete is mixed in this way than is mixed on the job.

There have been considerable developments in methods used for transporting and consolidating concrete, especially on large jobs. It used to be common practice to distribute concrete by chute and to consolidate it by hand working; today concrete is distributed by buggy or bucket, by conveyor belt (Figure 2) or by concrete pump and is frequently consolidated with the aid of vibrators. By these means, concrete of comparatively low slumps can be transported without segregation and be properly consolidated. An interesting develop-

Fig. 5. Precast panels of vacuum concrete at Columbia Cellulose Mill, Prince Rupert, B.C. (Creaghan and Archibald, Montreal)

ment is the "vacuum concrete" process.(14) In vacuum concrete, excess water is removed from the concrete after it has been placed in the forms by the use of vacuum mats. This changes the concrete from a fluid or semi-fluid to a solid with considerable internal friction, thus permitting the early removal of forms. At the same time, the water-cement ratio is lowered and the strength consequently increased. The process can be applied either to concrete in place or to precast concrete. There have been recent applications of the vacuum process in Europe and Africa, as for example a 10 ft. diameter pipe designed to withstand a pressure of 180 p.s.i., and a multistory building (Fig. 3) built of precast columns, beams and slabs, all made by the vacuum process.

To sum up, concrete today comprises a range of materials with compressive strengths varying from 500 to 12,000 p.s.i. or more, with some concretes gaining most of their strength in 24 hours, others taking 3 months; with some having excellent resistance to chemical attack, others much less; some almost impermeable, others completely porous; some with densities as low as 30 lbs. per cu. ft., others weighing 270 lbs. per cu. ft. This wide range of properties means that concrete is well adapted to a great variety of practical uses.

Precast Concrete

An impressive feature of present-day European practice is the extensive use made of precast concrete elements in building construction. Framing members, including roof trusses, secondary members such as joists, floor, wall and roof panels and even door and window frames, are extensively used. A typical European example of this type of construction is shown in Figure 4 and a Canadian example in Figure 5. In a recent American development known as the "lift slab" technique, the complete slabs for roofs and upper floors of buildings are cast on top of one another in a stack at ground level and are then jacked into place up structural steel columns.

Prestressed Concrete

The most important single development in reinforced concrete has been the introduction of prestressed concrete. Other significant advances include the use of high-strength reinforcement, the development of improved deformed bars and the use of more complex structural forms. The latter include two-way slabs, cylindrical, ellipsiodal and other shells, hipped plates, and domes. These structures are not necessarily complicated to build, but their design and analysis is usually difficult.

The idea of stressing reinforcement in order to compress the concrete initially and thus overcome its weakness in tension is by no means new, but the effective development of this idea may be said to date from 1928 when Freyssinet was granted comprehensive patents in many countries. Freyssinet appears to have been the first to realize that precompression of the concrete requires high-strength reinforcement, stressed initially to approximately 100,000 p.s.i. or more.

The general idea of prestressed concrete is illustrated diagrammatically in Figure 6, which is reproduced by permission of M. Magnel. The concrete is compressed initially before the application of external loads to the structure. These initial compressive stresses counteract tensile stresses caused by external loads and thus prevent cracking. Prestressed concrete has been successfully employed for buildings, bridges, airport runways, roads, the frames

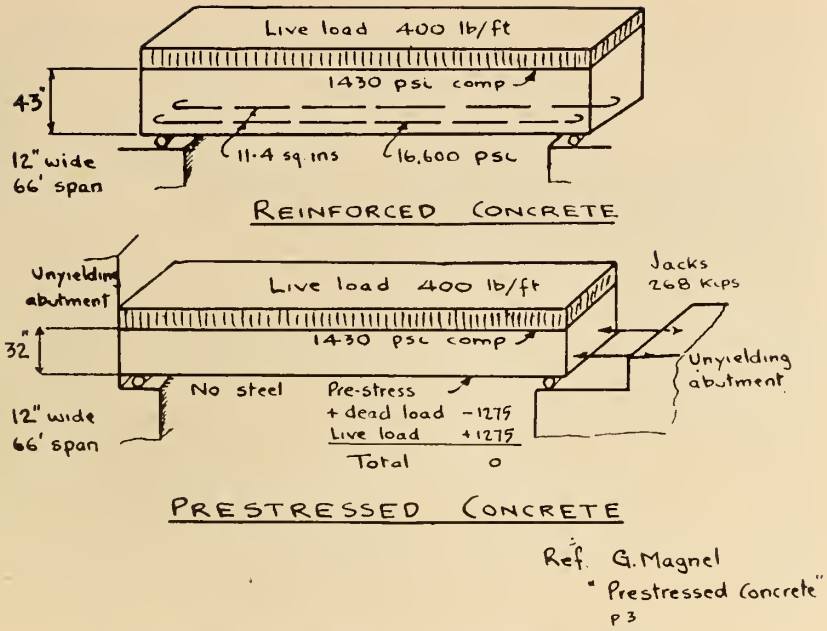

Fig. 6. Diagram showing principle of prestressed concrete. (From "Prestressed Concrete" by G. Magnel)

Fig. 7. Prestressed concrete tank under construction. (Pre-load Company of Canada Ltd.)

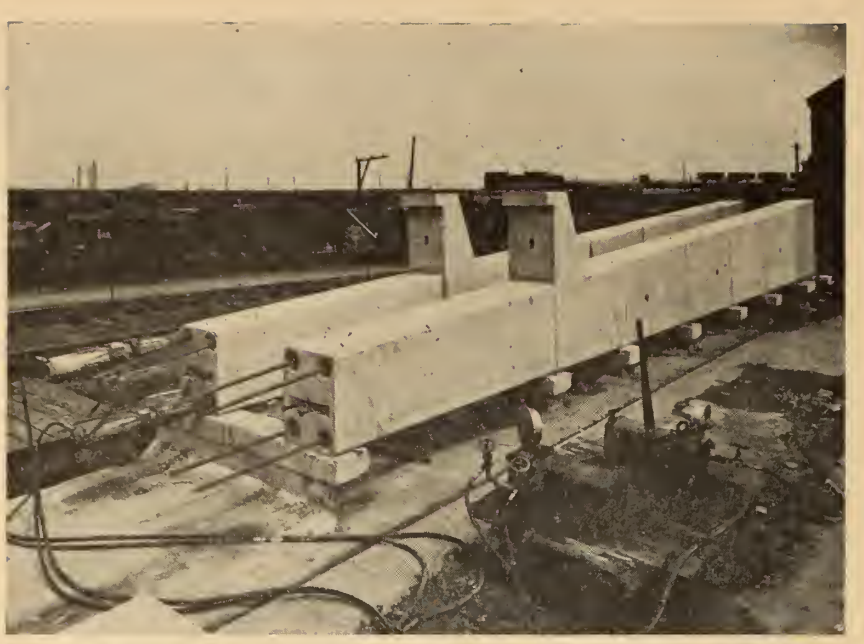

Fig. 8. Precast concrete columns being prestressed by the Freyssinet process at Newport, Wales. (Structural and Mechanical Development Engineers Ltd., Slough, England)

of large hydraulic presses, cylindrical tanks, railway ties, poles, piles and many other structures.(15)(16) Essentially it is a new material; considerable time and experimentation will be necessary to establish the circumstances in which it can be used more effectively than older materials, such as ordinary reinforced concrete and structural steel. The keen interest in this new material was demonstrated recently when over 500 engineers attended the first United States Conference on Prestressed Concrete at the Massachusetts Institute of Technology. There seems little doubt that it will be developed rapidly in the United States and in Canada during the next few years.

In comparison with ordinary reinforced concrete, prestressed concrete usually offers the following advantages:

(a) Saving in materials, generally about 50 per cent in concrete and 70 to 80 per cent in steel.
(b) Definite assurance against cracking of the concrete.
(c) Smaller deflections at working loads and moderate overloads.
(d) Larger deflections before failure, thus giving warning of dangerous overloads.
(e) Improved appearance.
(f) Smaller members, facilitating the use of precasting methods.

Although the first of these advantages is perhaps the most striking, the saving in weight of material is offset to a considerable extent by the greater unit cost of the materials used in prestressing and by its cost.

One of the first applications of prestressing was to cylindrical tanks and subsequently to spherical domes. Figure 7 shows a tank under construction by this method. Wires under tension are wound around the concrete tank so as to cause compression in the concrete and thus to prevent cracking when the tank is filled. The wires are subsequently covered with pneumatically applied mortar. The dome-shaped roof is also prestressed by means of a circumferential beam. Prestress, applied in this way, causes the dome to deflect slightly upward, thus facilitating the removal of formwork and centering. Another application is the mass production of prestressed concrete beams using the Hoyer system. In this process wires are stretched on beds several hundred feet in length, the concrete is then placed in suitable forms and the forces applied to the ends of the wires are released when the concrete has hardened sufficiently to pick up the stress in the wires by bond. This process has been very extensively used in Europe for the manufacture of beams, joists, poles and other comparatively small members. If desired these can be cast in considerable lengths and then cut off as required.

In the Freyssinet system of prestressing, holes are left in the concrete for the prestressing cables, which are inserted after the concrete has hardened. The cables consist of an assemblage of wires of comparatively small diameter and are tensioned using hydraulic jacks, and then anchored, using special wedging devices. As many as thirty wires can be tensioned and anchored simultaneously in this manner, though the usual number is twelve. The wires are subsequently bonded to the concrete by grouting, though this is not essential. Figure 8 illustrates the construction of columns for a factory building using this method. The columns when erected supported aluminum

Fig. 9. Esbly bridge, France, in course of construction. (Engineer E. Freyssinet, Photo H. Baranger)

alloy roof trusses. In this instance precast elements are used, but the system can be applied equally to cast-in-place construction.

Possibly one of the most interesting projects carried out to the designs of M. Freyssinet consists of a number of similar bridges over the river Marne in France. The first of these to be completed is at Esbly; it is shown in Figure 9. This bridge, with a span of 250 feet, is a two-hinged arch having a very small rise-to-span ratio. Such an arch would normally produce large horizontal thrusts at the abutments. These were reduced to practical amounts by the use of a prestressed concrete arch of very slender dimensions. This arch was composed of voussoirs, precast at a central plant and assembled into large units using prestressing cables. These units were then transported on barges to the site, lifted into place and prestressed.

Another extensively used system of prestressed construction is that of Gustave Magnel. This is similar in principle to the Freyssinet system, but the type of end anchorage and the method of applying prestress are different. Figure 10 shows a recent example of construction in Belgium, using the Magnel system. Roof beams of a hangar at Melsbroek, Belgium, constructed using this system, have a clear span of 165 ft. and each weighs 270 tons. They were cast on the ground and jacked into position. As another example of prestressed construction mention might be made of a single-story factory building in England using precast, prestressed columns, beams, rafters and purlings.

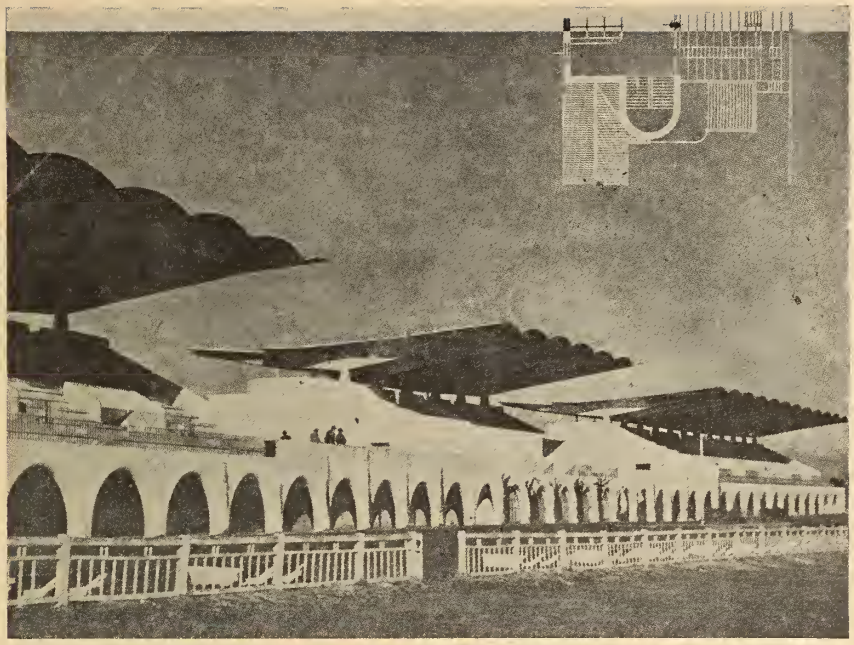

Fig. 11. Madrid Hippodrome. (Eduardo Torroja, Engineer)

High Yield Strength Reinforcement

Apart from the use of high-strength reinforcement in prestressed work — such reinforcement usually has an ultimate strength in excess of 200,000 p.s.i. — there is a trend towards the use of high-yield-strength steels in ordinary reinforced concrete. These steels include rail steel, the hard grades of billet reinforcing steel, twisted and twin-twisted bars, e.g., "Isteg" and cold-drawn wire. They have yields of about 60,000 p.s.i. and ultimate strengths of about 100,000 p.s.i. or better. Such steels offer the promise of significant economies through the use of higher working stresses. Reluctance on the part of specification writers to permit higher stresses is due largely to the fear that high stresses may mean objectionable cracking. Also, such bars are difficult to bend and to hook. These objections can be answered in large part by the use of deformed bars having improved bond characteristics. The chief producers of reinforcing steel are now concentrating their production on bars of this type. With deformed bars, hooking of the ends is seldom required and cracks at working loads are distributed so as to be almost invisible. It is interesting to note that deformed bars similar to those used today were being used 40 years ago. They fell into disuse then, because it was found that plain bars were quite satisfactory at the working stresses permitted. This is still true, and the economic advantages of high-tensile reinforcement will only be realized when recognition of their superior strength finds expression in codes and specifications.

Fig. 10. Garage in Belgium. (Engineer G. Magnel)

Plate and Shell Construction

It took a good many years for engineers to realize that continuity was a natural consequence of monolithic construction in reinforced concrete. This is universally recognized today and structures are designed accordingly. What is not recognized nearly so clearly is that reinforced concrete structures frequently con-

Fig. 12. Shell roof construction for the Quebec Arena. (Structural Engineers —Truscon Steel Co. Ltd. with Roberts and Schaefer Company as consultants for the roof design)

sist of assemblies of thin plates, either flat or curved. A plate is an extremely efficient structural member and the fact that plates of almost any desired size and shape can be readily built in reinforced concrete makes possible structures that are quite impossible in any other structural material. A familiar example of this type of construction is the flat-slab floor which was one of the first structures to take advantage of plate action. A highly developed form of plate construction is shown in Figure 11, which illustrates the canopies of the Hippodrome at Madrid. These were designed by the eminent Spanish engineer Eduardo Torroja. Another striking example of this type of construction is the stadium at Bordeaux, France, for which M. D' Welles was the architect. Hipped plate construction, consisting of structural assemblies of slabs without the use of beams or girders has been used extensively in Europe especially for bunkers and long span roofs.(17) Cell construction, which is somewhat similar, has been used with vertical cells for silos and with horizontal cells in the construction of buildings such as apartment houses.

Cylindrical Shells

Probably the most important new development in the use of plates has been the use of cylindrical shells for covering large rooms. Supporting columns and walls can be widely spaced when shells are used, thus giving very large clear working areas. There are two principal types of shell roofs, short shells where the length is small in comparison with the cross-section, (cross-barrel roof) and long shells where the length is considerable in comparison with the cross-section (longitudinal-barrel roof). Short shells have been used in Canada at Quebec and Victoria in the construction of arenas (Figure 12). Long shells are applicable to a wide variety of single-story buildings such as the one shown in Figure 13. In shell structures, the thickness of the shell in proportion to the span is very small. For example, a shell supported by a column spacing of 60 x 120 ft. may have a possible maximum thickness of 5 inches. In spite of this, shell structures are unusually rigid, provided the loads on them are uniformly distributed over their entire area.

The early development of shell construction occurred almost entirely in France and Germany and dates from about 1920. It was recognized that the subject presents great difficulties from the point of view of analysis and design, and these difficulties, combined with the unfamiliarity of most English-speaking engineers with the German language, were largely responsible for the slow introduction of concrete shell construction into Great Britain and North America. Developments were also slowed by considerations of patent rights. Within the past few years the situation has altered materially. On the one hand, there are engineering firms both in the United States and in Great Britain specializing in shell roofs and they have gained much experience both in design and in construction. On the other hand, simplified design procedures have been evolved and these have been published in English (18) (19). Contractors are discovering that shell structures can be built quickly and economically. This was well illustrated in Rotterdam, where shell construction was used extensively in the rebuilding of warehouses in the port area. In some instances these were constructed as a result of alternative bids submitted by contractors.

It is worth pointing out that the continental system of permitting and encouraging competitive designs for structures leads to more rapid technical advances. It is significant that both Freyssinet and Magnel

Fig. 13. Long cylindrical shell roof at Liverpool, England. (Cement and Concrete Association, London)

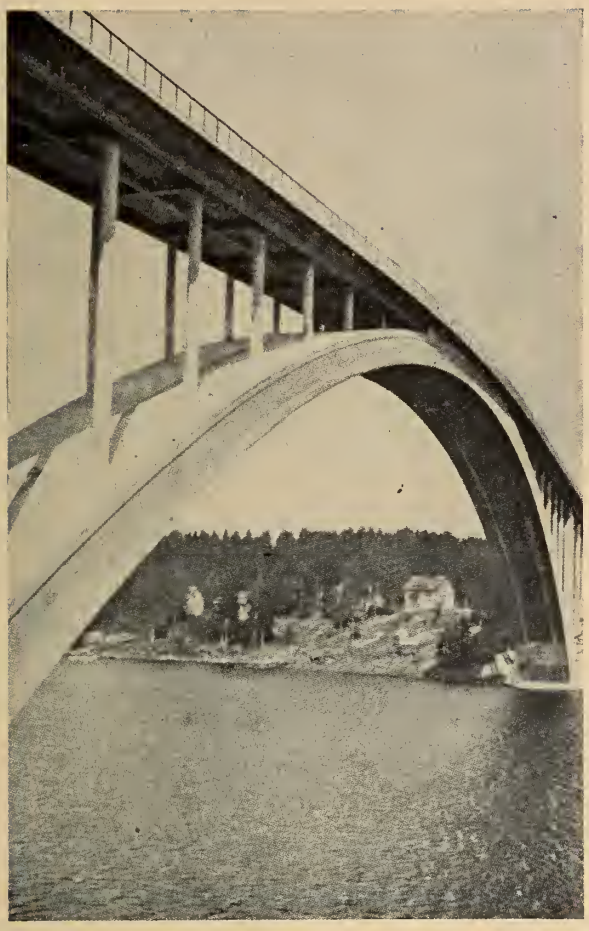

Fig. 14. Sando Bridge, Sweden, span 868 ft. (Photo, Travaux, Paris)

maintain close contacts with contracting organizations and that much outstanding work has resulted from this collaboration. It may be mentioned also that the city of Quebec when calling for bids for its Arena prescribed "only the functional requirements and stressed the need for rapid completion". (20) The result was an unusually economical building finished in ten months. An extension of this method of arriving at designs, for example in the field of highway bridge construction, would probably do more to accelerate concrete progress in Canada than could be accomplished in any other way.

Although shell construction has so far been limited to roofs of various types, there are possibilities of other applications. For example, Dischinger, who was largely responsible for the development of shell roofs in Germany, has recently proposed that shell construction be used for dams.

No summary of reinforced concrete progress would be complete without some mention of reinforced concrete arch bridges. The great bridge at Plougastel in France with three spans of 565 ft. each, built in 1930 to designs by Freyssinet was the record concrete span until the construction in Spain to French designs in 1942 of a railway bridge of 628 ft. span. This in turn was surpassed by the Sando bridge in Sweden constructed in 1943 and having a span of 868 feet. Figure 14. With these large arches the design and construction of centering is a major problem; it will be recalled that the Sando arch collapsed under construction owing to failure of centering. The second attempt to build this arch was successful. The economic limits of reinforced concrete arches are not yet known, but so far as design is concerned, it has been stated by Lossier(21) that on the basis of our present knowledge, arches of 5,000 ft. span can be built of reinforced concrete.

It must be remembered that reinforced concrete has only been used at all extensively during the past fifty years. It is still in many ways a new material, as we may confidently look forward to a continuation of the rapid technical development that has characterized the past twenty years. This was well stated by the President of the French Republic, M. Vincent Auriol, on the occasion of the centenary of the invention of reinforced concrete. "Pour le passé, cent années de recherches, de découvertes, de réalisations; pour l'avenir, des perspectives infinies et des possibilités encore insoupçonnées."

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An Analysis of Heat Transfer through Thermal Insulating Materials

A paper prepared for presentation at Heat-Transfer Discussions, London, England, September 11-13, 1951.

by

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Professor of Mechanical Engineering, University of Toronto, Toronto.

This paper deals with laboratory tests to determine the relative effectiveness of various methods in the use of insulating materials as barriers to heat transmission. It shows how radiation and convection both influence heat transmission through walls and ceilings insulated with light fibrous materials.

Most of the common thermal insulating materials consist of combinations of air and solid matter, arranged in such relative positions and proportions as to oppose the most effective barriers to heat transmission by means of conduction, convection, radiation or any combination thereof. The solid matter may be arranged in cells, powders, or fibres and the author suggested in 1939 (1) that a study of these structures "should throw some light on the probable relative effectiveness of various arrangements of air and solid, and may possibly indicate the directions in which future developments are most probable."

Further studies were made in this field and were published two years later but subsequently, war and post-war conditions delayed the resumption of the work until 1949-1950. The experimental work described herein was done on an 8-inch guarded hot plate constructed according to the specifications of the Bureau of Standards (Washington), and enclosed in a cylindrical tank so that the air pressure could be raised to 80 inches of mercury absolute or reduced to a minimum of 0.1 inch. The latter was the limiting pressure with air pumps available, but it proved to be sufficient for the purpose intended.

Radiation

Radiation was the first factor investigated, as radiation had proved to be an appreciable factor in heat transmission through some materials of low density. For example, Finck showed that Kapok (0.19 lb./cu. ft.) when dusted with aluminum powder showed a reduction of "apparent conductivity" k of 15.5 per cent, whereas at 1 lb./cu. ft., the effect of metallic dusting was negligible. Berchtold found that specimens of glass wool at 1, 3, and 6 lb./cu. ft. showed, respective reductions of 20, 9 and 7 per cent when the specimens were faced with aluminum foil.

The results of the Toronto tests are given in Table I, from which it appears that these air cells 8 in. × 8 in. × 1 in. transmit by radiation 74 per cent of the total heat (after allowance has been made for the emissivity of the metallic foil). Also, in the case of blankets of glass wool exceeding 2.0 lb./cu. ft. in density, the radiation effect appears to be negligible. The reason for the higher conductivity found when using aluminum foil and a material density of 3.5 lb./cu. ft. is not known. At 1.25 lb. density the loss is about 11 per cent and at 1.75 lb. it is approximately 2 per cent.

These results indicate also the importance of using surfaces of high emissivity on the hot plate apparatus itself, a practice used in the author's laboratory for the past twenty years.

Convection

The existence of convection currents inside powdered, granular or fibrous insulating materials has been remarked at various times by several investigators. The usual methods of investigation have been:

1. Testing the material in the horizontal, inclined and vertical positions, respectively. (Griffiths, Finck, Wilkes, and others.)
2. Dividing large specimens horizontally by thin partitions (Allcut and Ewens obtained differences of 14 to 40 per cent as compared with undivided specimens) and by varying the size of hot plate employed (Griffiths, Allcut) (2).
3. Varying the density of compressible materials, i.e., varying the size of air pores within the specimen. (Griffiths, Finck, Wilkes, Allcut, and others). Infiltration or leakage tests showed that the air passing through specimens of packed fibrous material increased very rapidly in amount as the packing density decreased (1).

The characteristic "hook" curves shown in Fig. 1 indicate that

below certain optimum densities the amount of heat transmitted by convection or by convection and radiation is appreciable.

4. Testing different thicknesses of material (Allcut and Ewens obtained increases in conductivity of 35 to 60 per cent on rock wool and glass wool respectively when the specimen thickness was increased from one to four inches) (2).

5. Varying the temperature difference between the hot and cold sides of the specimen. The conductivities of various materials increased with the temperature difference at rates which were independent of their respective densities (2).

6. Varying the air density within the pores or cells of the material. This was the method used in the following tests.

Table I

Specimen[a]	Density lb./cu. ft	Mean temp. ° F.	Temp. difference ° F.	Conductivity k
Air Cell:				
Paper Surfaces	....	82.0	25.7	1.06
Aluminum Foil Surfaces	....	90.7	36.0	0.278
Aluminum Foil Surfaces	....	76.2	40.8	0.276
Glass Wool Batts (White):				
Paper Surfaces (Brown—Thin)	1.25	86.1	44.0	0.356[b]
Paper Surfaces (White—Thick)	1.25	84.0	34.2	0.372
Aluminum Foil Surfaces	1.25	88.1	45.3	0.317
Paper Surfaces (Brown)	1.75	87.2	48.5	0.315
Aluminum Foil Surfaces	1.75	95.4	46.3	0.309
Paper Surfaces (Brown)	2.8	91.7	56.9	0.264
Aluminum Foil Surfaces	2.8	90.0	53.1	0.275
Paper Surfaces (Brown)	3.5	85.9	53.2	0.254
Aluminum Foil Surfaces	3.5	87.1	53.8	0.282 (?)

a All specimens eight inches square and one inch thick.
b Test repeated with same result.

Table II

Specimen[a]	Air pressure in. mercury	Mean temp. ° F.	Temp. diff. ° F.	Conductivity k
Air Cell (vac):				
Both sides faced with aluminum foil	29.94	76.2	40.8	0.276
	24.27	83.1	48.6	0.249
	9.06	83.1	44.2	0.225
	4.44	85.4	49.9	0.212
	2.69	92.3	60.1	0.206
	1.72	96.4	57.8	0.192
	1.18	98.1	63.5	0.191
	0.294	92.9	55.2	0.202
	0.220	92.1	59.8	0.200
	0.153	94.0	67.4	0.192
"Styrofoam":				
Density 1.34 lb./cu. ft.	29.9	81.4	33.1	0.307
	1.0	80.7	34.3	0.301

a All specimens eight inches square and one inch thick.

Effect of Reduced Air Density

As a preliminary to the testing program, air cells eight inches square by one inch thick were faced on both sides with aluminum foil and tested at different air pressures with results as shown in Table II.

These figures may be compared with those obtained under similar conditions when the same air cells were filled with various materials, as in Tables III and IV, and also when glass wool blankets were tested at different densities as in Table V. The theory of heat transmission under these conditions has been treated elsewhere, and will not be repeated here. It is generally agreed that cell or pore size has a considerable influence on conductivity, both in cellular and granulated materials.

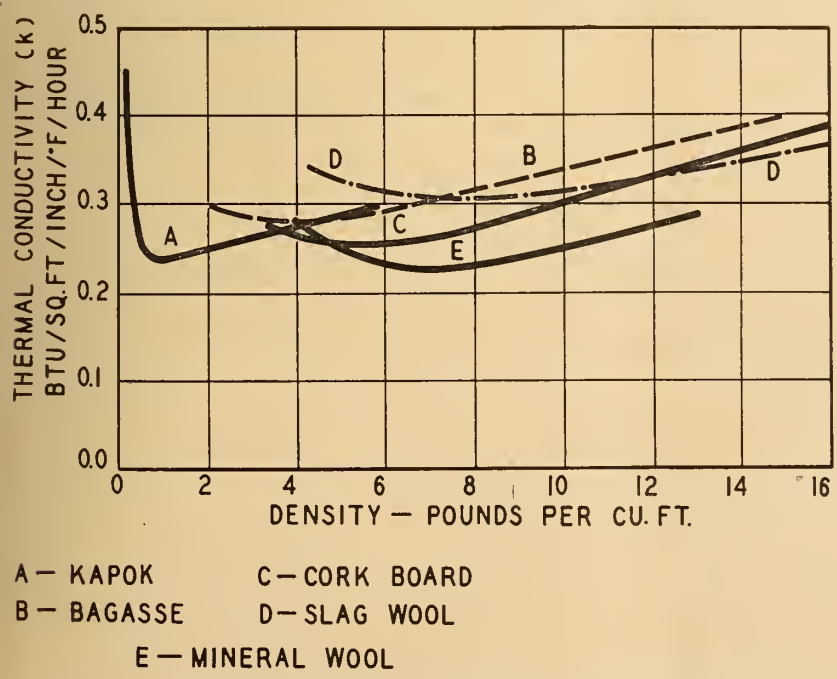

Fig. 1. "Apparent" thermal conductivity of various materials at different densities.

This is confirmed by the results obtained on "Styrofoam" (expanded polystyrene) as shown in Fig. 2, where the densities and sizes of the specimens tested by Dudgeon (University of Toronto) (7) were constant, the only differences being in the sizes of the pores. The latter varied from an average of 0.030 to 0.041 in. The thermal conductivities shown by the curve in Fig. 2 varied almost directly with the mean diameter of the air cells. It is interesting to note that Kestler and Caldwell (3) recorded a reduction of k for corkboard from 0.29 at atmospheric pressure to 0.087 at a high vacuum, indicating that nearly 75 per cent of the heat is transmitted through the air cells and about 25 per cent through the solid.

The air cells of Styrofoam were apparently impervious to this method of approach as the tests in Table II showed no perceptible difference in heat transmission between air pressures of 30 inches and 1 inch of mercury, probably because the cell walls were not porous and also withstood the pressure reduction without collapsing.

The influence of the "mean free

Table III

Specimen[a]	Air pressure in. mercury	Mean temp. ° F.	Temp. diff. ° F.	Conductivity k
"Santocel" [SAN] (Silica Aerogel) (with black filler) Density 3.88 lb./cu. ft. Particle Size 20–40 mesh (U.S. standard).	29.72	107.0	61.4	0.185
	21.5	103.3	65.8	0.179
	12.7	107.3	67.9	0.170
	9.28	108.0	73.2	0.162
	2.77	106.9	80.2	0.155
	1.84	112.0	76.4	0.149
	0.23	125.8	116.7	0.104
Ground Cork 6.03 lb/cu. ft.	29.9	82.0	44.2	0.262
Cork board 7.96 lb./cu. ft. ½ in. thick		73.5		0.272

a All specimens eight inches square and one inch thick.

Table IV

Specimen[a]	Air pressure in. mercury	Mean temp. ° F.	Temp. diff. ° F.	Conductivity k
Drinking Straws: Arranged Horizontally [ST-(H)] (cell faced with aluminum foil)	29.52	88.0	30.3	0.397
	14.46	91.0	31.0	0.393
Inside Dia. $\frac{5}{32}$ in. Wall Thickness .0085 in.	10.24	88.8	33.3	0.375
	6.09	88.8	29.4	0.366
	3.34	88.9	33.8	0.362
Arranged Vertically [ST(V)] (cell faced with aluminum foil)	1.14	87.1	31.7	0.347
	0.71	93.3	35.2	0.332
	29.90	84.0	31.7	0.402
	24.19	82.9	31.5	0.387
	16.60	82.7	32.6	0.388
	7.04	84.3	31.7	0.393
	4.6	84.6	30.2	0.377
Puffed Rice (P.R.) 4.36 lb./cu. ft. (cell faced with aluminum foil)	29.8	90.8	53.1	0.292
	24.5	88.5	52.5	0.278
	20.4	89.3	54.0	0.282
	14.7	89.3	55.3	0.270
	9.7	91.1	55.9	0.265
	4.35	91.4	58.1	0.261
	0.41	95.6	63.4	0.237

a All specimens eight inches square and one inch thick.

path" on heat transmission through gases at very low pressures has frequently been observed and accordingly many tests have been made at different pressures on powders of small grain size. The most important of these is silica aerogel, which has a conductivity comparable with, and sometimes below that of still air. Kestler and Caldwell found that the heat transferred through the air between the solid grains varied from 56 per cent in the larger sized grains (4-10 mesh) to 85 per cent in the smaller sizes (100-200 mesh) and the conductivity of the latter at very high vacua was about one third that of the former.

The conductivities in both cases become nearly constant at pressures below 0.01 mm. of mercury. Similar experiments were made at the University of Toronto on "Santocel," which is a commercial grade of silica aerogel powder with a black filler (probably carbon black) which was sieved to 20-40 mesh (U.S. standard). It was packed to a density of 3.89 lb./cu. ft. in a frame with cardboard surfaces. The results obtained are given in Table III and Fig. 3. The conductivity of 0.185 obtained at atmospheric pressure is very close to that of still air as given by Keenan and Kaye.

Tests were also made at various air pressures, on glass wool (Fiberglas) blankets cut from large "batts" of various densities. In each case the specimen was packed in a wooden frame with sides faced with aluminum foil so that, in effect, the conditions of the air cell tests were reproduced but, with the air entangled by glass fibres, the air "pores" became smaller as the packing density increased. An analy-

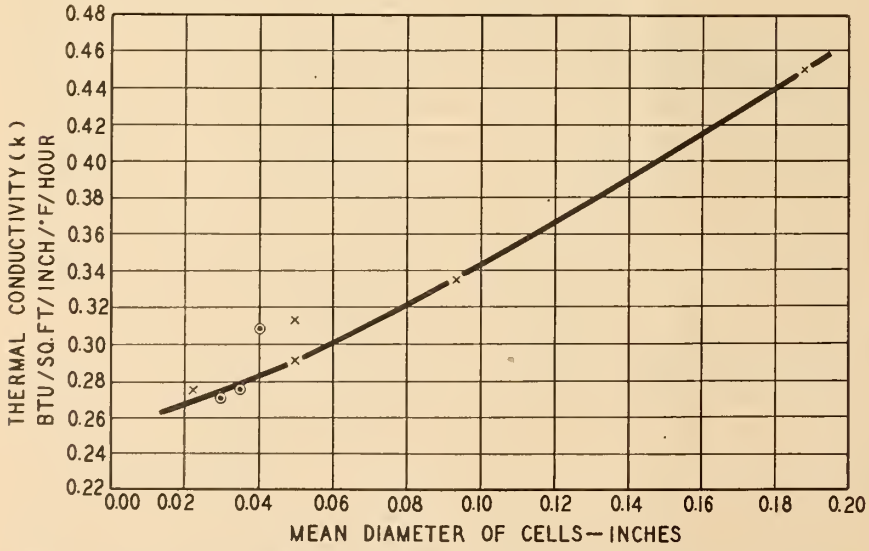

Fig. 2. "Apparent" thermal conductivity of expanded polystyrene of varying cell sizes. (Tests by McIntire and McCuaig and Dudgeon, respectively)

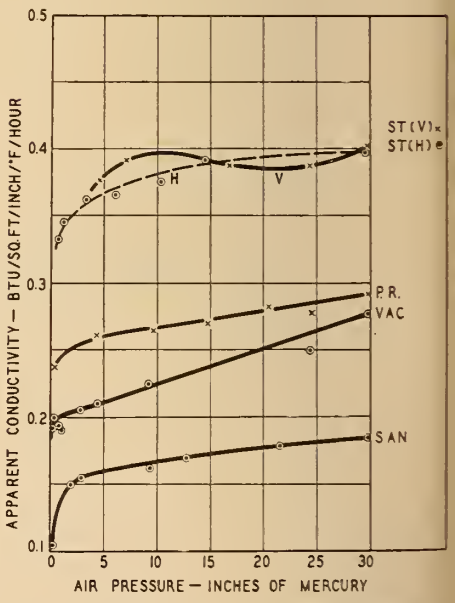

Fig. 3. "Apparent" thermal conductivities of various materials at different air densities.

St. V. & St. H.—straws arranged horizontally and vertically; P.R.—puffed rice; Vac—air space with aluminum faces; San—santocel (silica aerogel).

Table V

Specimen[a]	Air pressure in. mercury	Mean temp. ° F.	Temp. diff. ° F.	Conductivity k
Glass Wool Blankets or Batts (white)				
Density 1.25 lb./cu. ft. (G.WV3)	29.80	85.5	37.7	0.365
	29.90	81.6	38.6	0.359
	15.80	86.3	38.4	0.345
	9.49	87.7	40.1	0.333
	7.43	84.8	39.9	0.329
	3.52	85.3	40.8	0.330
	0.54	85.9	43.6	0.322
	41.0	85.4	37.3	0.371
	57.5	84.8	35.6	0.384
	80.0	83.6	33.6	0.404
Density 1.75 lb./cu. ft. (GWV2)	29.82	95.4	46.3	0.309
	22.36	96.1	46.4	0.304
	14.8	88.9	45.8	0.282
	9.0	89.1	46.3	0.279
	0.81	96.2	50.0	0.257
Density 2.45 lb./cu. ft. (GWV1)	29.78	91.9	46.6	0.322
	23.5	93.1	45.5	0.326
	16.92	86.0	37.5	0.302
	9.37	86.0	36.2	0.294
	0.65	92.6	50.7	0.283
Density 2.8 lb./cu. ft. (GWV5)	29.67	90.0	53.1	0.275
	26.12	88.1	52.2	0.281
	20.9	88.7	51.4	0.274
	16.8	90.7	54.0	0.269
	12.23	92.2	55.2	0.269
	5.98	92.9	59.0	0.263
Density 3.5 lb./cu. ft. (GWV4)	29.68	87.1	53.8	0.282
	25.5	86.6	54.4	0.276
	20.36	87.0	54.2	0.272
	15.02	85.5	54.4	0.268
	11.15	87.4	55.9	0.268
	6.97	88.1	55.9	0.264
	5.67	90.0	57.9	0.264
	3.11	90.0	58.8	0.261
	0.41	91.5	61.9	0.243

a All specimens eight inches square, one inch thick and faced with aluminum foil.

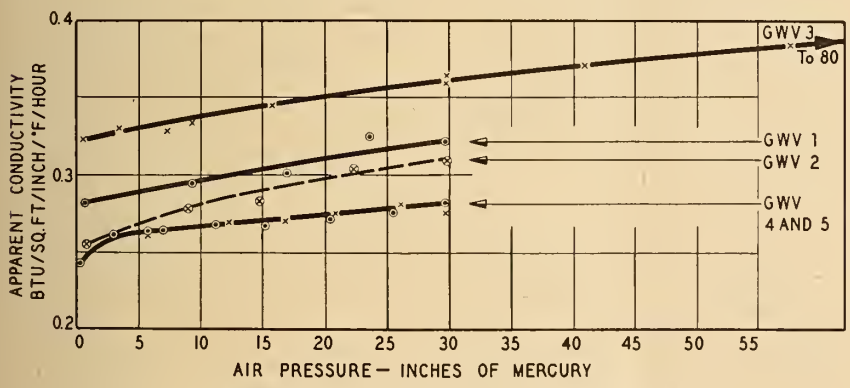

Fig. 4. "Apparent" thermal conductivities of glass wool different materials and air densities.

GWV 3—density lb./cu. ft. 1.25; GWV 2—density lb./cu. ft. 1.75; GWV 1—density lb./cu. ft. 2.45; GWV 5—density lb./cu. ft. 2.8; GWV 4—density lb./cu. ft. 3.5

sis of fibre sizes had previously revealed the fact that the volume occupied by the solid fibres at a packing density of 1.5 lb./cu. ft. was only about one per cent of the total volume of the air space (4). The results obtained in this series are given in Table V and Fig. 4.

In the tests made on glass wool at the lowest density (1.25 lb./cu. ft.) the effect of raising the pressure to 80 in. of mercury was also examined. A smooth curve was obtained above and below atmospheric pressure, as shown in Fig. 4.

It was also thought that larger sizes of air cells or pores of controlled form might give interesting results. Accordingly, the same frames were filled with wax-coated paper drinking straws, giving cylindrical and elongated cells of approximately constant size and shape. These were tested with the straws arranged horizontally and vertically, respectively, the surfaces of the frames being covered, as before, with aluminum foil.

The results obtained are given in Table IV and Fig. 3, and they indicate that there is little to choose between these two arrangements. For some unknown reason, the tests made with straws arranged vertically were less consistent than those with the horizontal arrangement. Also, it was noted that in several series of tests on various materials, lower "conductivities" than those expected from the form of the curve, were obtained at air pressures of about 25 in. of mercury. There is no apparent reason for this.

It was desired also to examine the effect of air pressure on the heat transmission through aggregates of thin spherical shells but, as these were not obtainable, the experiments were repeated on puffed rice, a breakfast cereal consisting of thin shells about 0.5 × 0.30 × 0.22 in. filled mostly with air. This material was packed to a density of 4.36 lb./cu. ft. and the results obtained are given in Table IV and Fig. 3.

Magnitude of Convection Losses

The work of several early investigators on air and other gases indicated that, if the size of the cells was large as compared with the "mean free path" of the gas, the reciprocal of absolute pressure when plotted against the reciprocal of conductivity resulted in a straight line relationship (5). This theory was confirmed by actual experimental results on air, up to a pressure of about eight inches of mercury. Beyond that pressure there was an increasing deviation from the straight line relationship owing to the increasing influence of convection.

Further work on powders, notably that of Kannuluik and Martin, confirmed this relationship which may be expressed in the form

$$\frac{p}{k} = ap + b$$

where p is the absolute pressure of the gas
k is the thermal conductivity
a and b are constants.

Thus if radiation is negligible or its influence is eliminated, the true conductivity can be calculated from the straight line and the extent of the deviations therefrom indicates the amount of heat transmitted by convection. Evidently, within the range of pressures indicated, differences of air pressure had no perceptible influence on the trans-

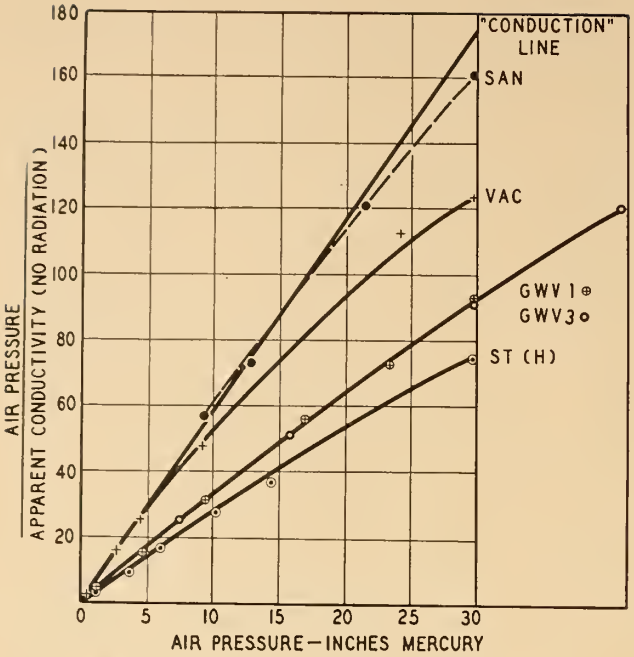

Fig. 5. Ratios of air pressure to "apparent conductivity".

Vac—air space with aluminum faces; GWV 1 & 3—glass wool; San—santocel; St.(H)—straws arranged horizontally "conduction line" refers only to air cell.

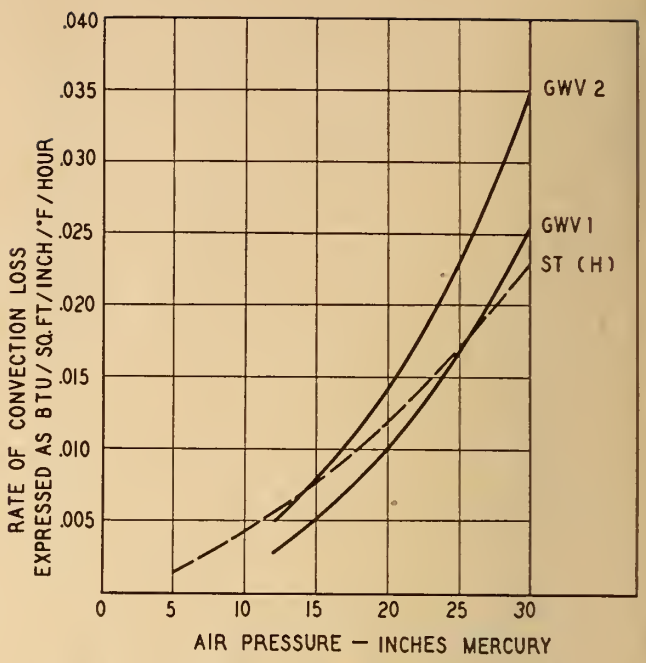

Fig. 6. Convection at different air pressures.

mission of heat through the solid matter present. This assumption has been made in the work that follows and curves of p/k against p have been plotted for all the materials and tests described above.

Some of these are shown in Fig. 5. The difference between the test curve and the straight line drawn tangentially to the lower end of the curve is then an indication of the amount of heat transmitted by convection. Some of these differences have been plotted in Figs. 6, 7, and 8 as calculated from the curves in Figs. 3, 4, and 5, at various pressures and they are plotted both as actual convected heat (expressed in the same units as k) and also as percentages of the total heat transmitted by conduction, convection, and radiation.

For the air cell at atmospheric pressure the experimental "conduction" line (Fig. 5) indicates a k for still air of 0.175 B.t.u./sq. ft. (deg. F. in. hr.), which is close to the value of 0.167 obtained by Taylor and Johnston, and is somewhat lower than the value of 0.187 given by Keenan and Kaye.

Similar curves drawn for the other materials and tests gave the results in Table VI. The curve for "Santocel" was practically straight at the higher pressures, and therefore it was assumed that in this material there is no appreciable loss by convection. This is probably true also for most fine powders. The figures for glass wool at 2.4 and 2.8 lb./cu. ft. are not quite consistent with each

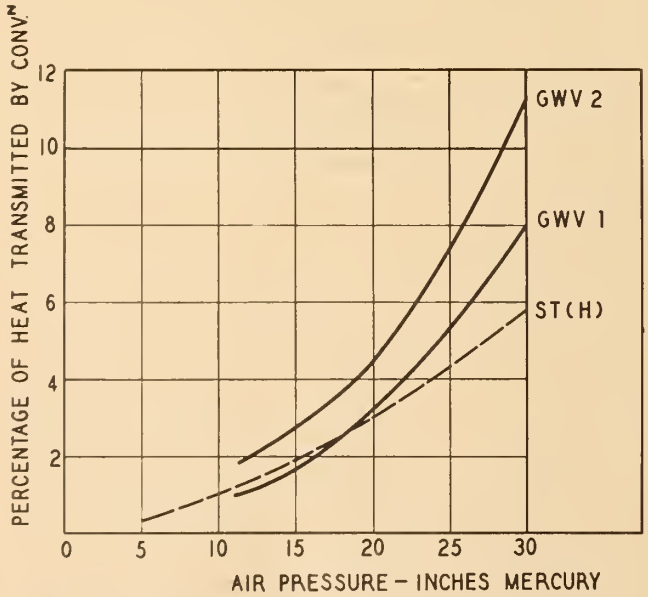

Fig. 7. Percentages of total heat transferred by convection.

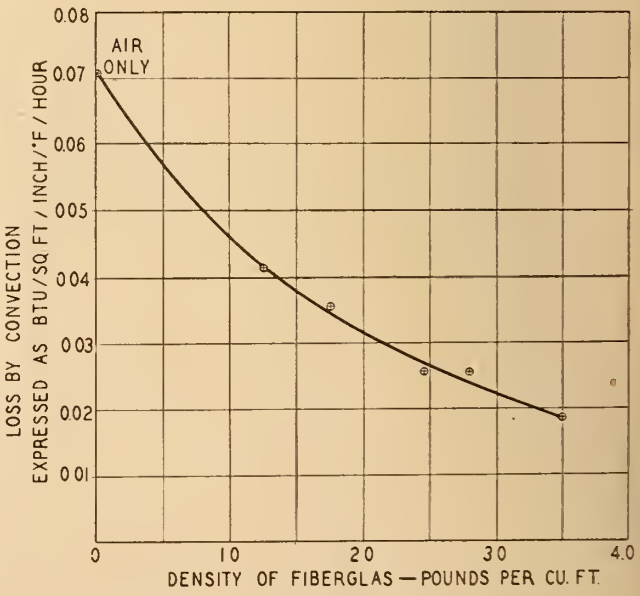

Fig. 8. Convection through glass wool at different densities with standard atmospheric pressure.

Table VI — Percentages of Total Heat Transmitted by Convection

Air pressure in. mercury	Straws (horizontal)	Puffed rice	Glass wool (various densities) 1.25 lb./cu. ft.	1.75 lb./cu. ft.	2.45 lb./cu. ft.	2.8 lb./cu. ft.	3.5 lb./cu. ft.	Santocel
30	5.8	9.2	11.4	11.3	7.8	8.6	6.7	Negligible
25	4.3	7.7	6.6	7.5	5.4	6.1	4.7	
20	3.0	5.0	4.1	4.9	3.2	3.6	3.0	
15	1.9	2.9	3.0	2.8	1.6	1.9	1.5	
12.5	...	...	...	1.9	1.0	...		
10	1.1		1.2			0.3		
5	0.3							

other but, in general, the convection effects at the different densities are reasonably so, as is shown by the curve in Fig. 8. The convected heat for the air cell at a density of 0.072 lb./cu. ft. is also included, as this is the logical end for that curve.

The degree of accuracy of the results obtained by this method of calculating convected heat is governed by the accuracy of the testing equipment itself, by the necessity of allowing for radiation in materials of low density and by the fact that the differences between the straight line and the test curve are small when the material tested has a low porosity. The results reported here apply only to the size of air cell used and the effects of convection would probably be greater if larger and wider air cells were tested.

The difficulty in the latter case would be the large size of containing tank and air pump required to reduce the air pressure sufficiently, though the tests reported herein seem to indicate that it is not necessary to exceed vacua of 28 to 29 inches of mercury. They show also, as has been indicated previously, that both radiation and convection can and do play appreciable parts in the heat transmission through walls and ceilings which are insulated with light fibrous materials.

The function k has frequently been referred to in this paper as "conductivity", since this is the term commonly employed, but it is both inappropriate and misleading. It is suggested that it might be renamed "apparent conductivity" or that some other suitable name might be selected to indicate the amount of heat transmitted by nonhomogeneous materials.

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THE ENGINEER'S PLACE IN THE DEVELOPMENT OF CANADA'S NATURAL RESOURCES

(*Continued from page 822*)

problems. This presages the thought that as a group, and as individuals, wherever the opportunity arises, we should be willing to accept posts of responsibility in the administration of industry and business, in government at all levels and in the social life of our communities.

You have only to go to the newer developments in Canada — Steep Rock, Yellowknife, Knob Lake, the Alberta oil fields, Kitimat, Port Radium and other place names of our healthy growth—to find the engineers in the forefront of development. They are the people who are dealing with broad problems, assuming wide responsibilities and playing a leading and vital role in bringing the Canadian way of life to remote areas.

His Excellency, the Right Honourable Vincent Massey, our Queen's personal representative in Canada, has written in his book, "On Being Canadian":

> "We are fortunate in Canada beyond our reckoning, in our national treasure; in our place on the great air highways of the globe and in our neighbourhood in America; in our links with the other British States; above all, fortunate in the skill and character of a people who can rise to any challenge. But there is one thing essential to all these advantages, and that is faith in ourselves. Without it, something will always be missing from the list. But with all the blessings which Providence has given this land we should have no cause for doubts. If the men of '67 were with us today, they would call upon us to move forward together with confidence and pride."

We are fortunate that we have in Canada a nation bountifully blessed with resources. Our country is young and the work of building it has really only started. But engineers have been in the forefront when seeing to it that the foundation for development has been well and truly laid. Let us see to it that the superstructure is something of which our children will be proud. √

ENGINEERING PROBLEMS RELATED TO ALBERTA NATURAL GAS

(*Continued from page 826*)

gas reserves. I know also that it is the policy of Alberta's Government that surplus gas may be made available for export. In fact, the Gas Resources Preservation Act makes this very provision. Presumably, those who would consider financing such a project would be able to assess the trends in growth of reserves and the policies of the Government and the Board, along with the more tangible factors, some of which I have discussed. √

Canada—My Home

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Halifax, N.S.

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

Legend has it that the first white men to see this country we now call Canada, were the Norsemen, who came along our eastern coast approximately 1,000 years ago.

Although Columbus proved the existence of these western lands in 1492, the actual discovery of Canada was by John Cabot, who in 1497 discovered Newfoundland and found the great fishing grounds of the North Atlantic which from that day have been so important in the economy of this country, particularly the eastern coast.

During the years 1534 and 1535 Jacques Cartier, sailing in the service of the King of France, mapped the coasts of Labrador and Newfoundland, discovered what is now Prince Edward Island, located the Strait of Belle Isle and the Gulf of St. Lawrence and sailed up the St. Lawrence River as far as the Isle of Orleans and the Indian village of Stadacona where the City of Quebec now stands. Leaving his ships at this point he finally reached the village of Hochelaga which was destined to become the great modern City of Montreal. He did not attempt to go beyond the Lachine Rapids.

The goal of these men was to find a short route to India and the Orient, where a great European trade had been developed in silks, spices and other oriental products.

Early Exploration

One of the great explorers and colonizers of the time was Samuel de Champlain who at the beginning of the 17th century carried on extensive exploration, discovery and settlement over a large part of the eastern side of this continent.

In the following years such men as Frobisher, Davis and Hudson carried on exploration, still looking for the road to the fabulous East. These men and many others have

I. P. Macnab, M.E.I.C.

left their names on the geography of this continent.

So through the years men with a spirit of adventure and a desire for trade and commerce, kept on exploring, seeking and discovering. MacKenzie, Cook, Vancouver, Franklin, Fraser, Thompson and many others gradually opened up new and exciting land, extending from the Atlantic to the Pacific and into the far reaches of the Arctic. They are the men who discovered the mighty rivers, the vast forests, the great plains, and the tremendous mountains which we have inherited as our home—Canada.

Although these early explorers may have failed to find the hoped-for short route to the riches of the East, they did uncover a wealth of sea and forest, a granary for the world and a mineral empire scarcely equalled, and in some respects greater than that on any other part of the globe.

This is the heritage that has been left to us to guard and to guide for future generations—Canada Our Home.

It may be noted that eventually the Northwest Passage was successfully navigated from east to west only as late as 1944. In that year the R.C.M.P. sailed their vessel the St. Roch from Halifax Harbour to Vancouver, having successfully completed the Northwest Passage, the search for which had begun over four centuries earlier. The explorer Amundsen made the passage easterly but only after an elapsed time of three years, having to spend two winters in the Arctic during the trek.

It is not proposed at this time to attempt to trace the history of the development of Canada to the present day, nor is it necessary that this be done. Suffice it to say that through the efforts of the early explorers, by the "blood, sweat and tears" of pioneering forefathers, Canada has come of age in the family of nations.

The Canadian Heritage

Many times we have heard it said that this is Canada's century, and after seeing Canada as I have seen it, the second half of the century can mean more to Canadians than the first half — if wisely used.

Let us briefly examine this inheritance that is ours. Stretching from St. John's, Newfoundland, to Victoria, we have ten provinces. During the past year I have had the opportunity of visiting all ten of these provinces, and of seeing at close range a great deal of what is going on.

In our newest province, Newfoundland, we have great assets in fishing, lumbering and mining. There would seem to be little doubt that, as the years go on these resources, under wise and careful guidance, will increase in importance.

In Nova Scotia we find fishing, mining, steel-making, shipbuilding and shipping, lumbering, paper-making, agriculture and other industrial activities.

In New Brunswick we have fishing, shipping, coal mining, lumbering, paper-making and agriculture.

In Prince Edward Island the economy is largely based on agriculture and fishing.

These areas, together with the eastern portion of Quebec, may be broadly classed as the Atlantic Maritime area. In this area much of the early history and development of Canada had its beginning. The early mining of coal, the making of steel, the great growth of early shipping with the famous days of windjammers, the home of the first responsible government, all had their Canadian beginning here. In this area we find the population largely made up of the descendants of the four great pioneer races: English, French, Irish and Scotch (Note: these are listed in alphabetical order, not in the natural order of importance which I would give them).

From these areas many of the great leaders of Canada have come.

Coming to the province of Quebec — we find an atmosphere and a culture not found in other parts of Canada, for here we find the people largely speaking another language, but still Canadians. We also find that there have developed in that province very extensive manufacturing, mining and agricultural activities, which with tremendous sources of power, developed and potential, give assurance of the continuation of present and of great future development. The province of Quebec, with the River St. Lawrence, also provides for great ocean-going traffic and trade.

When one visits the province of Ontario and has the opportunity of seeing the growth and development of that province, there can be little doubt as to its importance in the Canadian economy. This province, bordering as it does on the great inland waterways of Canada, extending into the far reaches of the north, endowed so lavishly by nature with all the elements which go to make up modern living, is at this time the centre of industrial activity as well as agriculture, mining, power and power resources, lumbering and all things necessary for such development.

And here we leave the so-called east, and enter Manitoba, where we see the beginning of the great grain growing areas of Canada, so aptly termed the "bread basket of the world". In addition we find that Manitoba is richly endowed with mineral wealth and more recently oil has been discovered within its borders.

Saskatchewan, also another great grain producing province, is richly endowed with mineral wealth and oil and there would appear to be little doubt of the opportunities for great development.

When the visitor arrives in the province of Alberta an entirely new world has opened up and so often I heard it referred to as "Oilberta". While in the past Alberta was famous principally for its cattle, its grain and its coal, it is now rapidly becoming one of the great oil-producing areas and also has important mineral wealth as well as large quantities of power. With such a situation, industry is rapidly moving on to take advantage of the facilities offered and that province surely is destined for a wonderful future.

In all three of the prairie provinces beef producing is an important industry and adds greatly to the over-all Canadian economy.

Here we leave the fertile plains and cross to British Columbia, a land bordering on the Pacific Ocean, a land of mountains, a land of fertile valleys, a land of mining beyond the dreams of avarice, a land of towering trees and great lumbering operations, a land of rivers providing for tremendous power, a land of shipbuilding, a land of fishing, a land of great cities and busy hamlets.

By the very nature of this continent we have inherited, its oceans and its rivers, its lakes and its mountains, its plains and its forests, the whole country becomes a great vacation land. It is therefore well that we take thought to preserve these great natural assets.

Northern Territories

This has been a brief word picture of the ten provinces making up Canada stretching 4500 miles, from the Atlantic Ocean to the Pacific and bordering on the 49th parallel. I have said nothing of the north and while I did not see much of the north on my travels, I did learn that here and there all over our great northern areas, mineral wealth and more mineral wealth is constantly being found so that it is easy to foresee that the day will come when much of the northland will be developed and become productive and be adding to the prestige and importance of Canadian economy.

In talking to a friend from Winnipeg he told me that he was selling equipment which was to be installed in a project which was as far north of North Bay as North Bay is north of Texas. So while we have been accustomed to thinking of Canada as a long narrow strip north of the 49th parallel, the time has come when we must raise our sights and consider these great spaces to the north which are Canada and which certainly give evidence of having great importance. When developed Canada will have breadth as well as length.

Future Development

While it is not proposed to make this a statistical record, it is important to note that Canada comprises 7 per cent of the world's area, but its present population is just over one half of one per cent of the world's population. From this it is evident that careful consideration must be given, as no doubt it is, but I think it should be intensified, to a forward-looking immigration policy to help develop this vast country. We must not forget that had our forefathers not been filled with the spirit of pioneering and adventure resulting in their emigration to the country, we could not have been here to inherit it.

One of the things which impressed me particularly over the whole trip was that so much of our production in almost all lines of activity was being exported in a raw or semi-manufactured state.

We in Canada are carrying a great financial burden of government and government services which must be paid for by only fourteen million people. I believe that a properly developed immigration policy is necessary so that this burden may be lessened per individual. With a larger market for consumer goods made available within our own borders, this in turn should result in a greater part of our productivity being manufactured for home consumption, resulting in greatly increased employment and national wealth.

When preparing for such a program of immigration it would seem advisable that a complete survey of the potential wealth, still undiscovered, should be made so that in selecting immigrants a proper distribution of the type of immigrant could be determined. It has been said that in the years gone by we have largely been bringing brawn to

(*Continued on page 853*)

FROM MONTH TO MONTH

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

Centennial of Engineering - 1952

Registration Procedure

It is expected that each of the societies participating in the Centennial of Engineering in Chicago, September 3-13 will arrange for the registration of their own members. Since some will be charging fees and some will not, the Centennial registration will be maintained separately in all cases.

A Centennial registration desk will be set up at the location of each principal society meeting conveniently near to the registration facilities of the respective societies. The actual registration will however be conducted by the separate staff of the Centennial Corporation.

There will be a registration fee of three dollars ($3.00) and each registrant will receive a Centennial badge and a master program covering all activities during the convocation period, September 3-13. Centennial registrants may purchase tickets for any of the special centennial functions scheduled for September 10 and the badge will permit attendance at the Convocation Symposia.

All participating societies have been requested to accept the registration badges of the Centennial Corporation as well as of each other for admission to any meeting or function during the convocation. Particular emphasis is being given to the fact that anyone is welcome to register and attend the various sessions even though they do not belong to any of the participating societies.

Association of Professional Engineers Formed in Newfoundland

Legal status was granted by the Provincial Legislature at its last sitting to the Association of Professional Engineers of Newfoundland and the inaugural meeting was held at Memorial University on Saturday, June 7. The purpose of the meeting was to select the first slate of officers for the Association and to discuss the setting up of its by-laws.

Representatives were present from all centres on the Island and as a result of the election, the following officers were installed:

President,
B. A. Monkman, M.E.I.C., St. John's;

Vice-President,
E. Dickenson, St. John's;

Councillors (for two years),
C. A. Knight, M.E.I.C., St. John's;
G. R. Jack, M.E.I.C., St. John's;
E. L. Ball, M.E.I.C., St. John's;
W. H. Maher, Buchans.

Councillors (for one year),
M. A. Foley, M.E.I.C., St. John's;
S. J. Carew, M.E.I.C., St. John's;
W. R. Hughson, M.E.I.C., Corner Brook;
W. L. Stuewe, M.E.I.C., Bell Island.

The act by which the Association is governed is closely modelled after the acts in effect in the other provinces of Canada and in particular, after the Nova Scotia act.

It provides that the investigation, design and construction of engineering works must be approved by qualified professional engineers who are members of the Association. In this the public is assured of the proficiency and competency of professional engineers in the practice of engineering.

The object of the Association has been stated as not to limit the number of professional engineers permitted to practice in the Province in the hope of creating a monopoly on engineering work but rather to function as a clearing house to check on the credentials of those wishing to practise professional engineering within the province.

Cover Picture

The Kootenay Lake Power Span. View of east tower looking directly across the Lake with insulator assembly in the top right foreground. A paper about the Span appears in this issue, page 815. *Photo courtesy Consolidated Mining and Smelting Company of Canada Limited.*

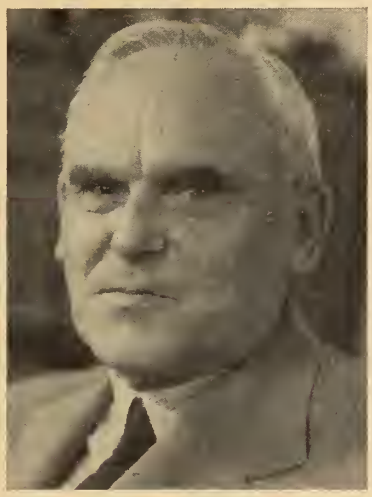
Hoover Medal Awarded to Right Honourable C. D. Howe

Notice has been received recently of the election of the Right Honourable Clarence Decatur Howe, P.C., HON.M.E.I.C., as the fourteenth recipient of the Hoover Medal (1952).

The Hoover Medal, one of the highest honours of the engineering profession, is awarded by the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Institute of Electrical Engineers and will be conferred on Mr. Howe on September 10, next, during the Centennial of Engineering in Chicago, September 3-13, 1952. The medal, first presented to Herbert Hoover in 1930 and named for him, is "awarded by engineers to a fellow engineer for distinguished public service".

The citation accompanying Mr. Howe's award is as follows: "To one of the world's great men, an engineer of vision, energy and decision with ability to get things done. His work has been a boon to his adopted country, to the country of his birth, and to mankind."

Mr. Howe, who was a consulting engineer before entering political life, graduated in engineering from Massachusetts Institute of Technology. He was professor of civil engineering at Dalhousie University from 1908 to 1913 at which time he became chief engineer of the Board of Grain Commissioners of Canada. In 1916, Mr. Howe established his own consulting practice under the name C. D. Howe and Company at Port Arthur, Ont. In 1935 he was elected to the Federal Parliament as Liberal Member for Port Arthur and on the formation of the MacKenzie King government he entered the cabinet as Minister of Railways and Canals and Minister of Marine. Mr. Howe has been re-elected at every election since that time and



The Right Hon. C. D. Howe, Hon. M.E.I.C.

has been Minister of Transport, Minister of Munitions and Supply, Minister of Reconstruction and Supply, and Minister of Trade and Commerce. In June 1946, he was appointed to the Privy Council of the United Kingdom in recognition of his work as Minister of Supply during the last war.

Mr. Howe was elected an Honorary Member of The Engineering Institute of Canada in 1951.

HALIFAX in 1953!

The *Journal* has reported previously that the 1953 Annual Meeting is to be in Halifax, but now it is able to give some additional and interesting information. The general secretary met with the executive of the Halifax Branch early in July, and has presented a progress report on the results.

The dates are May 20th, 21st and 22nd—a Wednesday, Thursday and Friday. This is a week or so later than the usual dates but there are two good reasons for the change. One is that the Halifax committee while expecting that the weather will be perfect as usual, believe that it might be a bit more perfect on the later dates.

The second reason is that the meeting is to be centred around Dalhousie University, and those are the best dates from the University's point of view. During recent years the suggestion has been made frequently that the annual meeting might be held at a university. Point has been given to the suggestion by the increasing congestion in hotels, and the rapidly increasing cost of hotel rooms and meals. These have gone so high that many members of the Institute—and in particular, young members, have been unable to participate. The Halifax committee has come up with the answer for 1953, and perhaps for other years and places as well.

The University through its women's residence, Shirreff Hall, and the men's residence, can provide single rooms for about 130 people. Also they can provide meals for this number and perhaps a few more. The rate is not yet settled but provisionally it has been set at $6.00 per day per room and three meals. Now don't rush!

The rooms are the usual residence type, small and furnished comfortably, but simply. There is no "with bath" set up, but ample facilities are provided at convenient locations. Because of this feature it is likely that men and women will be separated on different floors, but it is all very nice.

Technical papers will be given in the beautiful new Arts and Administration Building, where there are lecture halls ideally suited to the Institute's needs. Meetings of Council, branch officers and the student conference also will be held there in perfect surroundings.

Rooms have been reserved at both the Nova Scotian Hotel and the Lord Nelson Hotel. It is planned that persons wanting more "posh" accommodation than that offered at the University will make their reservations there. The hotel dining room facilities also will be in demand because the University cannot take care of everyone. The Halifax Branch will provide cars or buses for travel between the hotels and the University.

In order to reduce the over all cost of the meeting, it is planned to hold only two formal meals—one on the opening day and one on Friday night. For other meals members eat where and as they please.

The branch executive has a wide variety of ideas for Thursday afternoon and for the entertainment of the ladies. Few places are as well situated as Halifax to provide novel and interesting entertainment. Some sort of session "aboard ship" is bound to be on the program—probably for Thursday evening.

The technical program is under way and promises to be just as interesting as this year's at Vancouver. So all in all you will have low cost rooms and meals, perfect surroundings, good entertainment plus Halifax weather and hospitality.

It is going to be a great experience, better put the dates down now—May 20th, 21st and 22nd, 1953.

The Institute and The Associations

An important item on the program of the 66th annual meeting of the Institute in Vancouver was a panel discussion on the subject of "The Fields of Interest and Activity of the Engineering Institute of Canada and the Provincial Professional Associations". So many years have passed since the formation of the associations that a whole new generation has grown up to whom the early history of the associations and the Institute's part in creating them is almost unknown. This has led to many misunderstandings in many places, and so the Vancouver committee figured that an open discussion of this kind would be interesting, useful and profitable to all.

The Panel

Dr. Hector MacLeod, Dean of Engineering at the University of British Columbia was chairman. He introduced the four speakers and emphasized that this was "not a general debate, but rather a statement of views". He asked each panel member to speak for not more than six minutes and explained that after the speeches there would be an opportunity to question the panel members.

Representing the associations there were Robert A. McLachlan of Vancouver, a past president of the B.C. Association, and Huet Massue of Montreal, a past officer of the Corporation of Professional Engineers of Quebec. The Institute's story was presented by Ira P. Macnab of Halifax, president of the Institute, a past president of the Nova Scotia Association and a past president of Dominion Council. The second Institute speaker was John B. Stirling of Montreal, incoming president of the Institute and past president of the Corporation of Quebec.

Formation of E.I.C.

Dr. Macnab was the first speaker. He outlined the history of the formation of the Institute in 1887 and of its subsequent interest in the promotion of professional engineers' acts in the provinces. He explained that the organization was first called the Canadian Society of Civil Engineers because at that time engineers were called "civil" to distinguish them from "military" engineers. When the word "civil" came to have a restricted meaning, the name was changed to the Engineering Institute of Canada so there would be no suggestion that the organization was interested in the engineers of only one branch of the profession.

Model Act

Dr. Macnab told of the first professional engineers' act of 1896, which the Institute had had passed in Manitoba, and of the Quebec act of 1898, also obtained by the Institute's committee. These acts were difficult to enforce and so fell into disuse, although it is interesting to note that the act in Quebec in use to-day is the same one, with alterations, that was secured by the Institute.

The basis of all provincial engineers' acts is the Model Act produced by the Institute's committee of 1918. This was modified by the legislatures of each province before adoption, but in essence the provincial acts were all in accordance with the recommendations of the Institute's committee.

Fields of Interest

The Institute's next step was to clarify the fields of interest and activity between the two types of organization. Special meetings of the Council of the Institute took place in Montreal in 1926 and 27. One of the principal subjects discussed was the need of determining uniform admission requirements for all associations, and another was the desirability for establishing the fields of the associations and the Institute.

Finally a committee of the Institute, known as "The Committee on Relations of the Institute and the Professional Associations", was set up. Out of this committee came the Council of Seven, which eventually became the Dominion Council.

Dr. Macnab emphasized that, as shown in his short historical account, "the Institute was and has been the mother of the associations from the beginning". He pointed out that the Institute has always been ready to co-operate with the associations, as indicated specifically by the co-operative agreements in six of the eight provinces where there is provincial legislation.

He concluded with this statement: "I believe the Institute should deal with national matters, with the associations co-operating and looking after such matters as registration and regulations within their provincial fields, which is as far as they are legally entitled to act".

Differing Responsibilities

Dr. Stirling was the next speaker. He started with a statement referring to overlapping. Here is what he said:

"That there has been some overlapping of these activities in some of the provinces cannot be denied. It is my opinion, and the opinion of a good many others who have given the subject some thought, that the responsibility for this overlapping must be shared alike by some of the associations and by the Institute. The responsibility on the associations' part, I am convinced, is due to the misunderstanding on the part of certain individuals—I may say unwitting misunderstanding. They do not know the purpose

Participants in the annual meeting panel on "The Fields of Interest and Activity of the Engineering Institute of Canada and the Provincial Professional Associations", from left to right: Huet Massue, M.E.I.C., Robert A. McLachlan, M.E.I.C., John B. Stirling, M.E.I.C., Hector MacLeod, M.E.I.C., and Ira P. Macnab, M.E.I.C.

for which the association has been set up. On the other hand, I think the Institute is at fault because they have not convinced their membership with any certainty that the benefits to be derived by the members are proportional to the participation these members take in the society. They have not thought the thing through. I am sure that all of the engineers who have the best interests of the profession at heart will, following this discussion, see more clearly the functions of each organization, and I hope that they will make a serious effort to avoid duplication and overlapping of efforts and activities, and help to clear up in subsequent discussions any of the existing misunderstandings".

Interpretation of Objectives

To explain "the field of interest of the Institute", Dr. Stirling referred to the by-laws. He thought that those clauses, referred to as "objectives", first laid down in 1887, covered the ground completely. The objectives were he said:—

"(a) 'To develop and maintain high standards in the engineering profession'.

"I do not think that that requires any elaboration and I do not think that that objective will be disputed in any part at all. We are all agreed on that.

"(b) 'To facilitate the acquirement and the exchange and interchange of professional knowledge among its members'.

"This objective is of course implemented by various means, such as publication of the *Journal*, meetings, and the operation of the largest and most up-to-date technical library in Canada, now approaching 20,000 volumes, and the encouragement by the awarding of prizes and professional honours for the production of papers by members.

"(c) 'To advance the professional, social and economic welfare of its members'.

"Now I would say that many volumes could be written on this subject, and indeed have been written. The Institute's contribution to the advancement of the economic welfare of its members is made by means of promotion of professional knowledge and competence. We believe, as our past president, Dean Young of Toronto University, said, and I quote, 'You cannot legislate yourself into high places'. If you lack anything that it takes to become successful in your profession, namely professional competence, the Institute offers the best means of acquiring this continuing education after you graduate by means of participation in its activities.

"(d) 'To enhance the usefulness of the profession to the public'.

"This requires little explanation, as ample evidence is available readily as to the Institute's participation in public affairs.

"(e) 'To collaborate with universities and other educational institutions in the advancement of engineering education'.

"In this connection I need only mention the work of, first the Committee on the Young Engineer, second the Committee on Student Guidance in collaboration with the Canadian Institute of Mining and Metallurgy and the Canadian Institute of Chemistry, third the $25,000 educational fund which is being so actively used to enable young engineers to complete their education, fourth the setting up of student conferences from the 12 universities at our annual meeting, which we saw in such successful operation yesterday and these young men meeting at our luncheon table yesterday, fifth and last the active support of student branches in the various universities across Canada.

"(f) 'To promote intercourse between engineers and members of other professions'.

"This work is carried out by our special representatives on such bodies as the Canadian Chambers of Commerce, the Canadian Standards Association and many other such organizations.

"(g) 'To co-operate with other technical societies for the advancement of mutual interest'.

"This objective is an extremely important one in that it gains for the Institute's members the literature of all the American founder societies at the same cost as they can be obtained by members of these societies or at half the cost it would be to you if you were not members of the Institute. And, of course, any of the Engineering Institute members going to the States are extended the courtesies of the American founder societies just as if they were members. Just try out the Engineering Society of New York on West 39th Street and you will find that out. The same applies to many British institutions. Our cordial relations with the two Canadian technical societies, the C.I.M.M. and the C.I.C. are exemplified by our common membership with them in the Canadian Committee for Student Guidance. In connection with co-operation, I feel that the Institute is leading the way.

"(h) 'To encourage original research and study, development and conservation of the resources of the Dominion'.

"(I hope, ladies and gentlemen, that I can use the word 'Dominion' in this province without being criticized.) This requires little elaboration. Our committee work in this respect is well known—the committees on prairie water problems, conservation and many others."

Dr. Stirling concluded with the observation that, even though these objectives were established 66 years ago, "We have had a goodly measure of success".

Purposes of the Associations

The first speaker for the associations was Mr. McLachlan. He explained that his purpose was "to show you what are the purposes and methods of the associations in carrying out their functions". He agreed with Dr. Macnab's statement that "the only yardstick of the success of a provincial association was its service to the public" and pointed out how the B.C. Association kept that principle before it at all times. He went on to point out that the trend throughout this whole continent is towards governmental regulations of the profession.

The first duty of an association, he said, is the "setting up of standards for provincial members". In his opinion this was "the greatest single activity". After these were established, it was necessary to see that they were maintained. This led to regulations, codes of ethics, codes of conduct and so on. The administration of the regulations was the protection to the public from the practice of incompetent persons.

Mr. McLachlan stated that to administer a law properly you must "have the full co-operation of the members of the association". You cannot maintain this co-operation and interest "if you restrict your discussions entirely to the legal requirements of the particular group you are discussing". To maintain the members' interest, it is necessary to have some way to contact them. "That is the reason for the setting up in British Columbia of a rather controversial magazine, *The B.C. Professional Engineer*." He did not feel that the publication infringed on the field of any other publication

because it did not cover the same ground.

In a final summary Mr. McLachlan referred to the relations with other professions as part of the work of an association, also "salaries and wage scales and fees". He referred also to the work of the Dominion Council, which was organized to bring the associations together on such matters as standards, for registration, licensing and transfers.

Dominion Council

The next speaker for the associations was Dr. Massue. He confined his remarks largely to the work of Dominion Council, which was not precisely the field envisaged in the title of the discussion. He quoted at length from a communication from the president of Dominion Council, which gave the history of the Council, its set-up and its constitution. Also included was a reference to the Council not overlapping the provincial associations in its policy but through the concerted actions of the associations to present a national organization "should such joint representation be considered advisable and helpful".

Dr. Massue then showed slides of four charts he had prepared, the first to show the increase in the number of engineers from 1901 to 1951. The figures are 2,300 and about 25,000. Another slide showed the increase in the use of engineers in Canada. In 1901 there was one engineer to 2,100 people, but in 1951 there was one to 400 of population. The third slide showed the distribution of the membership of the Institute, and the last one showed the distribution of the membership of the provincial as sociations and the Corporation.

In conclusion, Dr. Massue said there was no doubt but that today's situation between the associations and the Institute required careful attention. "Our profession is one of young people and everything that these organizations do should be directed to the younger generation. They are going to take a greater interest in the profession. It is to be hoped they take as great an interest as did their predecessors".

The Questions and Answers

The notes on the panel session show that 13 questions were asked and answered. Some of the replies were very long, but here are the questions and a "boil down" of the answers.

Question 1. Is there any need for a central organization to represent Canadian engineers on the federal level?

Answer — I. P. Macnab.

Yes, but opinions vary so much across the country that it is not easy to get unanimity. There is a need, and the Institute is organized along that line. It is national in character and policy and has co-operative agreements with six of the eight associations.

Question 2. Since Dominion Council represents more engineers than does E.I.C., is it not the logical mouthpiece for Canadian engineers on the federal level?

Answer — J. B. Stirling.

The Dominion Council has only nine members, one from each association plus the president. The engineers of Canada are not members of it. The Council cannot act without the unanimous approval of all eight associations. A study of the 3,000 pages of minutes of all meetings of the Council fails to reveal a single important issue upon which the members have been unanimous.

The Canadian Medical Association speaks for the profession in Canada and yet its membership is only 4,400 out of over 10,000 medical men in the provinces. Similarly the Canadian Bar Association has less than 9,500 members out of a total of over 16,000 lawyers in Canada.

Question 3. Is it possible that the provincial associations might some day absorb the E.I.C.?

Answer — H. Massue.

"I do not think that is possible, and I think the best way is to have the associations and the Institute". The Institute has done a splendid job and it is important that it keeps on doing that job. It has a great field of activity and the best values from the Institute and the associations will come by promoting better understandings between the two.

Question 4. How can one society attempt to cover adequately the whole field of engineering from a technical point of view?

Answer — H. Massue.

The number of engineers in Canada is not great and it would not be wise to break this group up into specialty sections. In the United States and in England the numbers are far greater and they have had to organize into special groups. In Canada, for the time being at least, "several engineering societies would not do well and the field could be better covered by the Engineering Institute as the technical society."

Question 5. What group should represent professional engineers at the Centennial in Chicago this year?

Answer — Mr. McLachlan.

The Engineering Institute of Canada, as it is the corresponding society in Canada.

Question 6. Why was the B.C. Engineering Society formed? Does it duplicate the activities of E.I.C.?

Answer — Mr. McLachlan.

To maintain members' interest it is necessary to have something other than legal activities. The Society does not conflict with the Institute's activities. "Personally, I would like to see the technical activities of this Society and the Institute combined."

Question 7. Do changing conditions indicate any requirement for national registration of engineers to permit employment anywhere in Canada?

Answer — Mr. McLachlan.

Such registration should not be necessary. "Once uniform registration requirements are agreed upon by all associations, the free interchange of engineers throughout the provinces will be a matter of routine and perfect simplicity." Even now there is no difficulty in 90 per cent of the cases.

Question 8. What action is being taken by E.I.C. on the resolution made by representatives of voluntary societies and professional associations at the meeting at Saint John last year?

Answer—I. P. Macnab.

In view of the Dominion Council requirement that the associations must be unanimous before the Council can act, and being informed that the associations had not yet approved of it, the Institute has taken no action.

Question 9. Would you propose that Dominion Council be disbanded?

Answer — I. P. Macnab.

No. Dominion Council has useful work to do, such as the creation of uniform registration and standards across Canada.

Question 10. What are the annual fees of the Association of Nova Scotia?

Answer — I. P. Macnab.

Because of the co-operative agreement with the Institute, the joint fee, which covers both the Association and the Institute is only $20.00.

Question 11. Does the Nova Scotia Association maintain an employment bureau?

Answer — I. P. Macnab.

No. The Association restricts itself to registration and enforcement. The employment services of the Institute are used.

Question 12. As presently set up, the Institute and the associations, mainly the latter, are losing a great number of younger engineers. This is particularly so in the prairie provinces. Would a more direct consolidation with consequent reduction in secretarial and travelling fees be beneficial?

Answer — I. P. Macnab.

Agreed with the principle, but pointed out that it is particularly important for a national society to keep in close contact with its members and its branches. Favoured any co-operation that would reduce expenses.

Question 13. The Associations are legal bodies governed by statute and limited to the extent that one can write into a statute only the minimum requirements of technical competency. One cannot write into a statute the intangibles that go into making a profession. It is these intangibles that the Institute must maintain, which are the main reasons for its existence. Do you agree?

Answer — I. P. Macnab.

Yes, completely.

Dean McLeod thanked the panel and adjourned the meeting.

The Canadian Committee Meets Again

The Canadian Committee on Counselling in Engineering and Sciences was established in 1942. It was the expansion and extension of the work started by the Institute's Committee on the Training and Welfare of the Young Engineer in 1939 under the chairmanship of the late Harry F. Bennett. The guidance work of the Institute's committee was merged with the work of the Canadian Institute of Mining and Metallurgy and the Canadian Institute of Chemistry at the suggestion of the Advisory Board of the Wartime Bureau of Technical Personnel.

The Canadian Committee was set up first on the basis of one representative from each Institute. The chairmen have been Harry F. Bennett, London, L. F. Grant, Kingston, and G. R. Langley of Peterborough.

The work of the committee was quite comprehensive, embracing guidance material and service to the secondary schools, the undergraduate and the young graduate. Counsellors were set up in 151 centres to the number of 356, and bulletins were sent to them from time to time to keep them informed and aid them in their work.

Lately it has been appreciated that the greatest need for counselling is in the secondary schools. Also it became apparent that it was expecting too much of a three-man committee to ask them to handle counselling in all three fields at once. Consequently, the committee has been reorganized recently with three representatives from each organization and with new terms of reference. Another change is that the three secretaries are ex-officio members of the committee.

The new committee met first in Ottawa on March 27, 1952, and more recently on June 27th in Montreal. At the first meeting the objective was defined and terms of reference agreed upon. These were approved by the Council of the Engineering Institute in Vancouver on May 6th.

The Canadian Committee. Left to right, back row: T. E. Warren, C.I.C., C. Gerow, C.I.M.M., L. Austin Wright, E.I.C., R. G. K. Morrison, C.I.M.M., George B. Moxon, E.I.C., E. C. Allingham, C.I.M.M. Front row: Garnet T. Page, C.I.C., R. F. Shaw, E.I.C., W. R. McClelland, C.I.M.M.

At the Montreal meeting attention was given to procedures, and several decisions were reached. It is proposed to issue, in time for distribution this year, a pamphlet directed to high school pupils. This pamphlet will tell something about the profession, the qualifications necessary for success in it, where financial aid may be secured and how advice may be obtained from members of the profession. Admittedly there is available already much literature of this kind, but most of it is directed to prospective students in the United States and much of it is related to a single branch of engineering.

The new pamphlet will replace the booklet, The Profession of Engineering in Canada, first issued by the Engineering Institute in 1942 and reprinted in five issues, which up to now has been the one used by the committee. It will include references to the scientist as well as to the engineer, which was not the case with the E.I.C. publication.

However, it is planned to limit counselling to those branches of science and engineering that are represented in the membership of the three institutes. Persons requiring information in other branches will be referred to other publications and organizations.

The committee is inviting each provincial association of professional engineers to co-operate and to name a representative to the committee. In this way the representatives of the national groups can be aided materially in each province by provincial representatives. This too will promote useful co-operation between the associations and the institutes.

The biggest job for the committee will be the setting up of counsellors across Canada. This will be done through the branches of the institutes. Where there are branches of

more than one it is planned that the separately appointed counsellors will work together as one group, using a branch secretary as the contact man. It is expected that many of the counsellors appointed some time ago by the previous committee will be asked to serve again. It is hoped to have this whole organization complete and in action before the end of the year.

Other plans of the committee include the use of films, bulletins and the publications of other groups. The branches of all three institutes will be asked to hold at least one meeting a year dealing with counselling and the supply of engineering manpower material.

The decision to concentrate on the high school is based on several considerations, the most important being that the need for engineers can be met only by recruiting enough high school boys. Also it is recognized that engineering undergraduates already have good counselling facilities through the university faculty and that therefore there is little or no work for the committee to do at that level.

For the young graduate there is even less need for counselling. However, the senior engineers who make up the local counselling groups will be available to them at all times.

The members of the committee are as follows:—

For the Canadian Institute of Mining and Metallurgy:

Prof. R. G. K. Morrison	Montreal
W. R. McClelland	Ottawa
Carlyle Gerow	Montreal

For the Chemical Institute of Canada:

T. E. Warren	Ottawa
C. A. Winkler	Montreal
Garnet T. Page	Ottawa

For the Engineering Institute of Canada:

R. F. Shaw	Ottawa
G. B. Moxon	Montreal
L. Austin Wright	Montreal

The officers are:

R. F. Shaw, *Chairman.*
W. R. McClelland, *Vice-chairman.*
Garnet T. Page, *Secretary.*

The Secretaries Conference. Left to right: C. Gerow, Canadian Institute of Mining and Metallurgy; L. Austin Wright, Engineering Institute of Canada; Garnet T. Page, Chemical Institute of Canada.

The Secretaries Meet

In order to profit by each other's experiences and to keep the institutes close together, the three secretaries set up their own conference last year, to meet at least once a year. This year the date was June 23rd and the secretaries were Carlyle Gerow of the Canadian Institute of Mining and Metallurgy, Garnet T. Page of the Chemical Institute of Canada and L. Austin Wright of the Engineering Institute of Canada. The meeting was held in Montreal, and started at 9.30 a.m. concluding at 4 p.m.

The agenda included a great variety of subjects such as annual meeting arrangements, programs, hotel service and prices, activities with the students, publications, joint activities, procedures regarding delinquent members, resignations, removals, changes of address, collection of arrears, staff salaries, allowance for illness, days off, vacations, etc.

At noon the secretaries were entertained at luncheon by the senior officers of the societies in Montreal.

Such meetings are very helpful and contribute much to the co-operation of the three societies. It is apparent from the beginning that the problems of one are the same as the others. Joint discussion of these and the exchange of experience go a long way towards developing solutions. At the same time these meetings develop opportunities for joint activities and for enlarging the usefulness of all three groups to their members.

New officers of the Nova Scotia Mining Society, elected at the annual meeting in Sydney, N.S., on July 3rd. Left to right, front: J. A. Russell, president; D. J. MacNeil, past president. Back row: S. C. Miflen, secretary-treasurer; R. Charlick, 1st vice-president; Frank Doxey, second vice-president.

Maritime Professional Meeting

of

THE ENGINEERING INSTITUTE OF CANADA

and

THE ASSOCIATIONS OF PROFESSIONAL ENGINEERS

of

NEW BRUNSWICK AND NOVA SCOTIA

Algonquin Hotel, St. Andrews-by-the-Sea, N.B.

September 10, 11, 12, 1952

Advance Program

Wednesday — September 10th

All day **Registration**

2.00 p.m. **E.I.C. Council Meeting**

5.00 to 9.00 p.m. **Informal Gatherings**—dinner and social entertainment

Thursday — September 11th

10.00 a.m. to 12.00 noon **Registration**

10.00 a.m. **Professional Sessions**

(a) "Recent Electronic Aids to Navigation"
by Capt. H. R. Smyth, D.S.C., M.B.E.,
Head of Radar Development Section,
National Research Council, Ottawa

(b) "Power Potential of Saint John River"
by Reginald E. Tweeddale, M.E.I.C.,
Development Engineer,
New Brunswick Power Commission

12.30 p.m. **Opening Luncheon**
Speaker: Dr. E. O. Turner, M.E.I.C.,
Dean of Engineering,
University of New Brunswick,
Fredericton, N.B.

2.00 p.m. **Cruise on M.V. "Grand Manan"**
Golf or Swimming

7.30 p.m. **Banquet**
Speaker: J. K. Jamieson, M.E.I.C.,
Director, Imperial Oil Co. Limited

11.00 p.m. **Lobster Party**

Friday — September 12th

10.00 a.m. **Professional Sessions**

(a) "Passamaquoddy Tidal Power Project"
by Herman J. Kropper,
Chief of Planning, Seaports Branch,
New England Division,
Corps of Engineers, U.S. Army

(b) "Business Activities Down East"
by O. Nelson Mann, M.E.I.C.,
Professional Engineer,
Department of Trade and Industry,
Province of Nova Scotia

1.00 p.m. **Luncheon**
Speaker: Dr. J. B. Stirling, M.E.I.C.,
President,
The Engineering Institute of Canada

2.30 p.m. **Golf Tournament**

7.30 p.m. **Banquet**
Speaker: John Fisher,
Roving Reporter and Radio Commentator

10.30 p.m. **Grand Ball**

Saturday — September 13th

9.30 a.m. **Breakfast and Open Discussion**

4.50 p.m. **Train departure**

Registration — Members $7.00 — Ladies $3.00

The Committee

General Chairman . . . . . A. G. Watt, M.E.I.C.
Joint Chairmen . . . . . John Reed, M.E.I.C.
D. O. Turnbull, M.E.I.C.
General Secretary . . . . . J. A. Flood, M.E.I.C.
Publicity and Speakers . . . R. M. Rice, M.E.I.C.
Papers and Meetings . . . . D. R. Webb, M.E.I.C.
Finance and Registration . . . T. C. Higginson, M.E.I.C.
Transportation . . . . . S. B. Cassidy, M.E.I.C.
Advertising . . . . . R. L. Parsons, M.E.I.C.
Entertainment and Sports . . F. L. Doty, M.E.I.C.
Ladies . . . . . Mrs. John Reed

Few Engineering Grads Go to U.S. for First Job

(From *Labour Gazette*, June, 1952)

Contrary to beliefs in some quarters, comparatively few of Canada's engineering graduates emigrate to the United States for their first jobs.

A report of the Technical Personnel Division of the Department of Labour, which obtained its information from four of the leading universities in Canada, states that last year less than one per cent of the graduates from these universities went to the United States. It is expected the proportion will run about the same this year. Even among those who do go, many go only for the purpose of taking post-graduate training in United States universities.

According to the report, three factors which tend to influence the decision of Canadian engineering graduates to remain at home were:—

1. The great expansion taking place in Canada offering good job opportunities for all engineers seeking employment.
2. Starting salaries offered by Canadian employers, for graduates with degrees, at bachelor level, compare favourably in most cases with those offered by United States companies. The former difference between salaries paid in the United States and Canada is fast disappearing. (Some exception to this situation seemed to be the case for those with advanced degrees, who were frequently able to secure better offers in the United States than in Canada.)
3. The United States draft regulations act as a deterrent in some instances to emigration. Young Canadians are liable for military service after a period of residence in the United States.

News of Other Societies

The 33rd annual convention of the **Canadian Good Roads Association** (270 MacLaren Street, Ottawa, Ont.) will be held at Quebec City in October. Details will be announced by the Association.

The **Chemical Institute of Canada** has scheduled the western regional conference to take place in Saskatoon, Sask., October 24-25, 1952.

Dr. A. B. Van Cleave, University of Saskatchewan, Saskatoon, is secretary of the organizing committee.

The **Engineers' Society of Western Pennsylvania** has announced the thirteenth annual water conference, to take place October 20, 21, 22, 1952, at the Hotel William Penn, Pittsburgh, Pa. Information may be secured by writing to the Society office in the Hotel William Penn, Pittsburgh.

John Dawson Coleman, of Dayton, Ohio, executive of the Frigidaire Division of General Motors Corporation, was recently elected president of the **National Society of Professional Engineers**, Washington, D.C.

The president of the **American Society for Testing Materials**, elected recently at the 50th anniversary annual meeting of the Society, is Dr. Harold Lee Maxwell, supervisor of mechanical engineering consultants, E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

The international machine tool exhibition to be held at Olympia, London, England, from September 17 to October 4, 1952, is being organized by the **Machine Tool Trades Association** (Victoria House, Southampton Row, London, W.C.1).

The twenty-first international congress for housing and town planning will take place at the Technical University, Lisbon, Portugal, September 21-27, 1952.

Information can be obtained from the headquarters of the **International Confederation for Housing and Town Planning**, Bezuidenhoutseweg, 75, The Hague, Netherlands.

Correspondence

Employment Service

Of the over one hundred recruitment agencies we have used during the last year and a half, The Engineering Institute has been one of the most valuable, and we would like to express our thanks for your wholehearted and successful co-operation.

N. A. Macdougall,
Personnel Consultant,
Brazilian Traction, Light & Power Company, Limited,
Toronto, Ont.

A Report from Europe

Having now lived away from Canada over two years, I am beginning to value news from home more and more. One of my most interesting contacts is *The Engineering Journal* which helps to keep me posted on engineering developments and discussions in Canada. The economic development of our country is highly regarded by everyone I have spoken to over here, and a specialized company has recently been set up by one of the big Swiss banks for the placing of European funds in Canada.

Our work at the Centre d'Etudes Industrielles continues to be absorbing and I am now busy writing reports on the City of Vancouver as an industrial complex and the pulp and paper industry in Canada. We have just returned from a two-week trip to Germany to study the complex of industries in the Ruhr area, and are holding a number of round table discussions on what we saw there.

Some of the firms we visited were interested in Canada as a potential customer or even as a base for starting operations in North America.

We students are now preparing for field training which will take place during the summer months. I myself will spend nine weeks in Rorshach on the Lake of Constance near Zurich. One of Aluminium Limited's subsidiaries has a small rolling mill there. Other groups will work in Italy, England, Norway, Denmark, and Germany. As yet, none of us know where we will be posted when the course finishes at the end of September.

Harvie D. Walford, jr.e.i.c.,
Centre d'Etudes Industrielles,
Geneva, Switzerland.

Volta River Project

Some time ago I was engaged by Sir William Halcrow and Partners as their chief engineer for the construction of the new 12-berth

harbour at Tema in the Gold Coast and all necessary preliminary works.

This work, as you may know, is part of the Volta River Project which is primarily to create sufficient power for the reduction of aluminum by the construction of a dam across the Volta River about one mile wide and 260 feet of water at the dam face.

This project is to some extent identical with the project now under construction at Kitimat in northern British Columbia, but will be only about half that of the Canadian undertaking; still it is a huge project, the estimated cost possibly in the neighbourhood of a hundred million pounds. The harbour and the ancillary work may be fifteen million pounds.

In this connection I had the pleasure of meeting Mr. Nathaniel Davis, president of Alcan and Mr. F. L. Lawton and Mr. Richardson of the same Company, all of Montreal.

I only arrived in Accra about five weeks ago and as there is no definite Government authority as yet to proceed with the construction of the Port, I have been engaged in analyzing the surveys for the railways and roads, very necessary communications for transporting the heavy machinery to Tema from Takoradi.

The mention of Takoradi recalls many happy and interesting times to me, for it was just about 30 years ago that Messrs. Stewart and McDonnell's original party of engineers landed on the beach between Sekondi and Takoradi on the Gold Coast, the party consisting almost entirely of Canadians. The late General J. W. Stewart, C.M.G., D.S.O., who, in his days was one of Canada's biggest railway contractors; Colonel the Hon. Angus McDonnell, C.M.G., D.S.O., was and will still be remembered, since the days when he was on Earl Grey's staff and later became associated with Jack Stewart under the firm of Stewart and McDonnell. Other well-known Canadian people who landed on that sandy beach were C. R. Crysdale, recently chief engineer of the construction of the 80-odd miles of new railway from Quesnel to Prince George, with A. G. Graham as his deputy. James McGregor, whose name will be remembered in connection with the construction of the old Grand Trunk Pacific Railway, was the chief engineer for the design and construction of Takoradi Harbour and all ancillary works.

W. H. Hunt, M.E.I.C.,
Chief Engineer, Port of Tema,
Accra, Gold Coast.

CANADA — MY HOME

(*Continued from page 843*)

the country. The time has definitely arrived when a balanced selection of brains must be included and I am happy to see that there is evidence that this is now being done.

The Engineer's Part

Speaking as a Canadian engineer to Canadian engineers, it is a great satisfaction to report that throughout industry generally engineers are more and more taking an active part in the direction and control of industry in this highly scientific and industrialized world.

More and more the people of the world are depending on the engineer and the scientist for their very existence. This is particularly true in Canada where all phases of industry are progressing so rapidly and where the potential for future development is so great.

It seems evident therefore that the goal for all industrial, scientific and technical men is for closer co-operation. The scientist, whether he be engaged as physicist, chemist, geologist or in some other field, is essential to the research and development of technical and scientific skills, while on the other hand the engineer is essential in the development, manufacturing and economical use of the theories and processes developed by the scientist. For the sake of Canada, Our Home, and its future we will do well to so relate and co-ordinate our professional activities that the greatest good may result to generations yet unborn.

It is evident, in many places, that in the past there has not been sufficient attention given to the conservation of our inheritance.

It would appear that the quick dollar has in many cases been more important than the long-time overall economy. We have seen in other countries the effect that such a policy can have in the destruction of nature's assets. While in the past we, as a nation, have been prodigal of our resources, we are still endowed with great potential wealth. It is our responsibility as scientific and technical men to make sure that our future course of action is to build Canada for the future.

This has been a wonderful year for me. I sincerely thank you, the members of our profession, for making it possible for me to have seen Canada as I have seen it.

I am now passing the burden and privileges on to my successor, but to the younger men of our profession must go the responsibility of developing this our homeland, not only with the goal of personal gain, but with the high purpose of making this country, inherited by us from our forefathers, a better place in which to live. With this as a goal and maintaining always the high standards as set out in the ethics of our profession, there is no doubt that personal reward will follow as the day must follow the night. To you, the members of our profession in Canada, I pass on the burden of carrying on — my stairs are getting harder to climb.

Addresses Wanted

In order that our membership records may be as complete as possible, it would be greatly appreciated if any available information regarding the whereabouts of the following members could be sent to us with the least possible delay.

A list of Members and Juniors, for whom we have no addresses, was included in the July issue of the *Journal*.

Students

Abram, Herbert Lloyd
Adair, Robert John
Armstrong, Robert Switzer
Bachovzeff, Constantine
Bartley, James F.
Bates, Arthur John Clark
Beaudoin, Julien
Bechamp, Leonard
Bell, Francis Aubrey
Bertrand, Fernand
Bewley, Kenneth George
Bibace, Bertie Maurice
Bookbinder, Leonard
Bouchard, Raymond
Bouchard, Ulric
Bourgault, Gerald
Breneol, Loring J.
Brown, Kenneth
Bruneau, Roger
Bruneau, Paul
Buchanan, Wm. Lyall
Buckley, Hugh Wall
Butcher, Jack Irving
Cambridge, Ronan Malcolm
Cameron, Donald Alexander
Carter, William Frederick
Carulla, J. Enrique
Castro, Francisco
Chauvin, John Henry
Clarke, David Whitfoot
Connell, Earl T.

Corelli, Charles Rae
Cornish, Newman Glen
Couture, Jean-Marie
Crossley, John H.
d'Andrade, Manuel Joseph
Delorme, Marc Wilfrid
De Laet, Christian
Dick, Jean-Paul
Dimas, Theodore
Dougall, Arthur McDougall
Dowsett, James Wilbert
Drouin, Jacques Emmanuel
Dubnie, Amil
Ducharme, Raymond
Duff, Graham Haliburton
Dufour, Louis-Rene
Dufour, Marcel
Ehrenholz, Eugene
Evans, Ronald William
Fafalios, John Dimitrios
Farren, Douglas William
Fernandez, Guillermo
Flintoft, John Davidson
Floyer, David Cornish
Forestell, Ray A.
Fortin, Gilles
Foster, Robert Laird
Frenkiel, Andre
Gagnon, Denis Albert
Garneau, Dominique
Gaudet, Lester Preston
Gilbert, Francois
Gauthier, Robert
Goodings, Robert A.
Gornall, John Charles
Gosselin, Andre C.
Gradley, Paul Kenneth
Grainger, William Dean
Hacking, Robert Vincent
Hansen, Peter Edward Vetterstrom
Hanson, James Henry
Harvey, Chas. Bernard Miville
Haraldsen, Kjell
Hebert, Raymond Oliver
Hechter, Sidney
Hill, Kerry Maxwell
Hlavay, Joseph F.
Hopkins, Herbert Arthur
Hopkinson, Eric Clayton
Hudon, Honore
Hudon, Jean-Marc
Hyde, John Howard Blake
Innis, Robert Peter
Jacobs, Gordon Donald
Jay, Cecil E.
Jermyn, Robert Stephen
Jerome, Ronald Jacques
Jonas, John J.
Jonsson, Asgeir
Kennedy, Clyde Crawford
Kennedy, John William
Klimchuk, John
Knight, Allan Frank
Kowalski, B. G.
Lacroix, Yvon
Lalande, Jean-Marie
Langlois, Claude
Laporte, Edmour
La Riviere, Joseph Ernest
Lariviere, Jean
Leclair, Lucien
L'Ecuyer, Paul Ronald
Lee, John
Leroux, Marcel
Levesque, Benoit
Lindsay, Nicholas
Livingstone, Michael Andrew
Lyon-Hall, Robert Claude
McBain, Mervyn Neilson
McCabe, Miss Martha Virginia
McClelland, John Harold
McCulloch, Donald Edwards
McCullogh, Kenneth Bruce
MacDonald, Ian Ross
MacKay, Howard Warren
MacKean, Raymond Rhodes
MacKenzie, Donald Colin
McKinnon, Maxwell Duncan
MacNeil, Bernard Malcolm
Macrakis, Nicholas
Maheux, Marcel Romeo
Major, Joseph Edmond Urgel Roger
Malone, William Vernon
Margison, Clayton Archibald
Matsubayashi, Mickey Carlton
Matte, Richard Paul
Mattuck, Morris
Meek, John Quinn
Miller, Keith Jones
Milne, George Hector
Miner, Benjamin
Minogue, Lorne Edwin
Montpetit, Jean-Guy
Moore, Ralph Mitchison
Morel, Albert Constant Cecil
Morissette, Armand
Morrison, Clark Arlington
Mulas, Alberto
Murray, James Archibald
Murray, James O'Connor
Nakash, Albert
Nash, Leslie Raymond
Nichlom, Julius Adolphe
Ormond, John Cadman
Ouellet, Andre
Papadopoulos, Anastassios
Paradis, Jean Guy
Patterson, Frank William
Perdue, Joseph Henry
Plass, Roger
Primeau, Raymond
Quinn, Edward Russell
Rabinovitch, Moses
Ramos, Jaime Cesar
Reynolds, Horace Francis
Roe, Lloyd Allan
Rollins, Burton
Robin, Guy
Ross, Sidney Craig
Romanowicz, Walter Joseph
Rousseau, Jean
Roy, Anthony Hector
Roy, Paul
St. Pierre, Ludger
Salem, Philip Edward
Sauve, Claude Georges
Schwandt, Arthur Lester
Schwartz, Howard William
Sheenan, John Oliver
Shifflett, Elwaine William
Sklar, John
Smalley, George Franklin
Smith, Gerald Merton
Sophianopoulos, Alexander Augustus
Spinney, Ralph Hubert
Steverlynck, Yves
Stone, Fred Kilner
Strother, Gerald
Stunden, Kenneth Edward
Sullivan, Joseph
Sutherland, Charles Alexander
Terlecki, Henry
Todasco, Alexander
Trepanier, Lucien
Trew, Willis Errol Ray
Vaillancourt, Raymond
Vaudry, Stuart Arthur
Van Stolk, Albert Gerard
Waldie, William Frederick
Walton, John Sheppard
Waterlow, Ian
Watson, William Bryce
West, Eric Arthur
White, Arnold George
Wigmore, William Frederick
Woodliffe, Michael Frederick
Yarmoshuk, Nick
Yue-Shing, Tai

Headquarters Records

Each time the *Journal* or other Institute mail is dispatched we are advised of undeliverable items due to incorrect addresses. Our records staff must follow up these changes and the regular service to members suffers thereby. *Please* advise headquarters when your address or occupation changes. The form below can be completed, clipped, and mailed to headquarters in a few moments.

Please Print

Name.....
Surname Given names

Home Address..... ☐

Employer.....

Employer's Address..... ☐

(Check address to be used for Institute mail.)

Product or Service.....

Position or Title.....

Degree, Year & College.....

Advise Headquarters Promptly of Changes

Personals

News of the Personal Activities of Members of the Institute

J. L. Shearer, M.E.I.C., was elected president of the Ontario Good Roads Association at the 50th annual meeting of that body held recently.

Mr. Shearer, who is engineer to the Ottawa Suburban Roads Commission, is a past chairman of the Ottawa Branch of the E.I.C.

J. L. Shearer, M.E.I.C.

F. L. Lawton, M.E.I.C., chief engineer of the power department of the Aluminum Laboratories Limited has been elected president of the Canadian Electrical Association. Mr. Lawton is chairman of the Montreal branch of the Institute and has recently been honoured with the grade of fellow by the American Institute of Electrical Engineers.

He is a past vice-president of the American Institute of Electrical Engineers and a vice-president of the Canadian Electrical Association.

D. B. Steinman, M.E.I.C., of New York City, builder of bridges on five continents and known as "the poet who writes in steel" has received the second award ever given by the National Society of Professional Engineers for distinguished services to the engineering profession.

Born in Brooklyn, Dr. Steinman studied at City College of New York and later he won three scholarships to Columbia University where he took A.M., C.E. and Ph.D. degrees.

Dr. Steinman was engaged for the building of the Florianapolis bridge in Brazil, the largest bridge in South America. Other famous bridges he has built, include the Henry Hudson bridge, the St. John's bridge in Portland, Oregon, the Thousand Islands bridge, the Sky Ride at the Chicago World's Fair, the renovation of the Brooklyn Bridge, the Mount Hope bridge in Providence, R.I. and many others. He has been retained to construct the Straits of Messina bridge between Sicily and the mainland of Italy.

Dr. R. S. Jane, M.E.I.C., vice-president of Shawinigan Chemicals Limited has been elected president of the Chemical Institute of Canada. He has been vice-president of the Chemical Institute since 1951.

Dr. Jane joined the Shawinigan Company in 1929 and is at present in charge of research and development and is a director of the Company.

He is also a director of the Shawinigan Resins Corporation, Springfield, Mass., and Canadian Resins and Chemicals, Montreal, Que.

Dr. R. S. Jane, M.E.I.C.

Born in England, he was educated in Vancouver, B.C., graduating from the University of British Columbia in 1922. He received a Ph.D. degree in chemistry from McGill University in 1925 and attended the London University in England for the following two years on a Wembly Scholarship.

He is a member of the Society of the Chemical Industry and of the Compressed Gas Manufacturing Association.

N. W. McLeod, M.E.I.C., asphalt technologist with Imperial Oil Limited and engineering consultant, Department of Transport, Ottawa, has been awarded the Charles B. Dudley medal for his paper entitled "Application of Triaxial Testing to the Design of Bituminous Pavements." This medal is presented for a paper of outstanding merit constituting an original contribution on research in engineering materials and this is the first time the award has been received outside the United States since it was established in 1925, to commemorate the name of the first president of the A.S.T.M.

Dr. Norman McLeod, M.E.I.C.

Dr. McLeod was born in Ontario and educated in Saskatchewan where he became research engineer with the highway department before joining Imperial Oil Limited in 1938.

He holds degrees in science from the Universities of Alberta, Saskatchewan and Michigan and in 1946 won the U.S. Highway Research Board award for a paper on airport runway evaluation.

F. G. Ferrabee, M.E.I.C., vice-president and general manager of Canadian Ingersoll-Rand Company Limited at Montreal, Que., has been elected representative for the McGill Graduates' Society on the Board of Governors of McGill.

P. N. Gross, M.E.I.C., vice-president and general manager of the Anglin-Norcross Corporation Limited, has been made a member of the board of directors of the McGill Graduates' Society.

Drummond Giles, M.E.I.C., president and general manager of Courtaulds (Canada) Limited has been appointed regional vice-president for Quebec and Eastern Ontario for the McGill Graduates' Society.

George Cole, M.E.I.C., former director of Mines for the Department of Mines and Natural Resources, Manitoba Branch, at Winnipeg, has been made regional vice-president for the Prairie Provinces for the McGill Graduates Society.

Dr. J. J. O'Neill, M.E.I.C., has received an honorary life membership of the McGill Graduates' Society. Dr. O'Neill recently retired as head of the University's geology department and dean of the engineering faculty, and a biographical outline of his career appeared in the July issue of the *Journal.*

W. D. Hurst, M.E.I.C., a director of the American Water Works Association, has been elected chairman of the Canadian Section of the A.W.W.A.

T. J. Lafreniere, M.E.I.C.

Mr. Hurst is city engineer and commissioner of buildings in Winnipeg, Manitoba.

Mr. Hurst is a past chairman of the Winnipeg branch of the Institute, past

W. D. Hurst, M.E.I.C.

chairman of the Minnesota section of the A.W.W.A. and a member of the Association of Professional Engineers of Manitoba. Since 1931, he served for several years on the council of the Association and is a past-president.

T. J. Lafreniere, M.E.I.C., is past-chairman of the Canadian Section of the American Water Works Association.

Mr. Lafreniere is chief engineer of the Ministry of Health, Province of Quebec, Montreal; Professor of Sanitary Engineering, Ecole Polytechnique; Professor of Public Health Engineering, School of Hygiene, University of Montreal; Lecturer in Sanitary Engineering, Laval University.

He is chairman of the Board of Examiners of the Corporation of Professional Engineers of Quebec; and a member of the New England Water Works Association, the Canadian Institute on Sewage and Sanitation, The Canadian Public Health Association, and the American Public Health Association.

C. G. R. Armstrong, M.E.I.C., has been appointed vice-chairman of the Canadian Section of the American Water Works Association.

Mr. Armstrong is a consulting engineer at Windsor, Ontario. He is a graduate of the University of Toronto. Since 1944, Mr. Armstrong has operated his own business under the name of C. G. Russell Armstrong, consulting engineer, and Ontario Land Surveyor. He is an active member of the Border Cities Branch of the Institute, is a past-

C. G. R. Armstrong, M.E.I.C.

chairman and served two years as councillor. He has been president of the Ontario Land Surveyors Association.

Other officers elected to the executive committee of the Canadian Section are: **Trustees:** C. S. Anderson, of South Porcupine; **I. P. Macnab,** M.E.I.C., of Halifax, immediate past-president of the Institute and general manager of the Public Service Commission of Halifax; W. R. Catton, of Brantford; A. H. R. Thomas, of New Toronto; **F. Y. Dorrance,** M.E.I.C., Divisional Engineer, Public Works Department, Montreal; **V. A. McKillop,** M.E.I.C., assistant general manager and secretary of both the Public Utilities Commission and the London Railway Commission; W. T. Randall, Equipment Association representative; J. L. McAvity, Maritime Branch representative; and **A. E. Berry,** M.E.I.C., director of the Sanitary Engineering Division, Ontario Department of Health, Secretary-Treasurer.

G. F. Layne, M.E.I.C., is retiring as vice-president and general manager of Price Brothers and Company Limited.

Born in Barbados, B.W.I. he attended Harrison College, Barbados and later McGill University, graduating from the latter with a B.Sc. degree in mechanical engineering in 1914. On graduation he

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enlisted, serving one year with the Canadian Field Artillery and four years with the Royal Field and Royal Garrison Artillery in France and Palestine. On being demobilised, he was employed as draughtsman first with Ingersoll-Rand and later with the Laurentide Company. In 1921 Mr. Layne joined Price Brothers and Company Limited as technical engineer located at Kenogami, Que., and subsequently held the following positions with the company; assistant mechanical superintendent, Kenogami mill; mechanical superintendent, Riverbend mill; chief engineer, paper division, later becoming chief engineer with headquarters in Quebec City.

Mr. Layne served as councillor, representing Saguenay Branch of the Institute in 1927 and again in 1933 to 1934. He was elected vice-president of the Institute for the Province of Quebec in 1946.

Hector Cimon, M.E.I.C., former vice-president and secretary of Price Brothers & Company Limited, in Quebec, has been named executive vice-president of the Company, succeeding Mr. G. F. Layne, M.E.I.C.

Mr. Cimon studied at Laval University where he received a B.A. degree in 1912, and at Ecole Polytechnique, Montreal, where he received the degree of B.A.Sc. in civil engineering in 1916. He joined the engineering staff of Price Brothers & Company upon graduation, and became secretary of the Company in 1939, and vice-president in 1946.

He has served the Quebec Branch of the Institute as secretary-treasurer, as councillor, vice-chairman, and chairman, and he was vice-president of the Institute in 1942-43. He was re-elected this year as councillor to represent the Quebec Branch, and a biography appeared in the April *Journal*.

P. E. Cooper, M.E.I.C., president and general manager of Pacific Mills Limited, Vancouver, B.C., is associated with the new Elk Falls Company newsprint mill at Duncan Bay. The company is a copartnership of Canadian Western Lumber Company and Pacific Mills.

Born in Canada, Mr. Cooper, former deputy director and general manager of the Thames Board Mills Limited, at Purfleet, England, was called to the position of vice-president and general manager of Pacific Mills in 1943, and was elected president in 1944.

He has been in the paper business 28 years since joining the International Paper Company as construction engineer. He was appointed resident engineer of the Piercefield mill of International Paper in northern New York State in 1929. Later he was manager of the Rumford mill of the Continental Paper and Bag Corporation at Rumford, Me. He resigned soon after to join the Thames Board Mills as chief engineer in charge of design and construction of a new board mill and took over as general manager and director of the Thames Company until he moved to Vancouver and his position with the Pacific Mills.

He was educated at McGill University where he graduated in civil engineering and he is a member of the McGill Graduates' Society.

A. C. Northover, M.E.I.C., has been appointed managing engineer of the first Water and Sewerage Corporation of Great Corner Brook, Newfoundland. Mr. Northover will be responsible for the functional organization, maintenance and operation of a utility system

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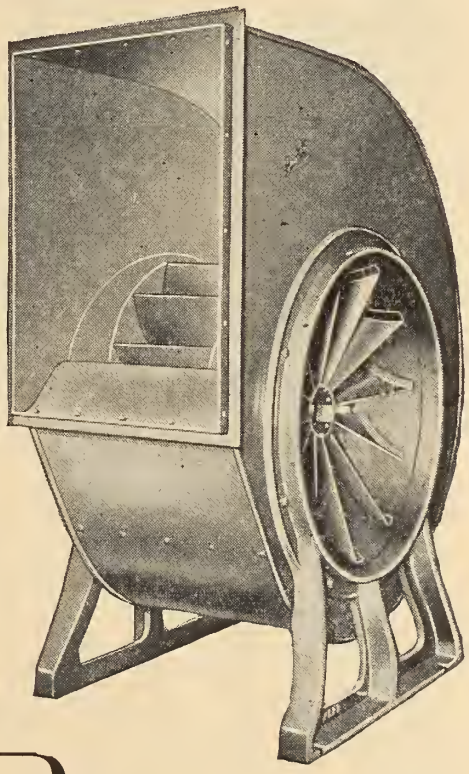

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to serve 20,000 people. Professor R. DeLand French, M.E.I.C., is engaged as consulting engineer for the project.

Mr. Northover has established three utility engineering organizations during the last seven years, including the towns of Leamington, Midland and the township of McKim, Sudbury, Ont.

R. O. Stewart, M.E.I.C., has been appointed chief engineer of the Canadian National Railways to succeed **Barton Wheelwright,** M.E.I.C., who retired after 41 years service.

Mr. Stewart, a native of Lindsay, Ont., is a graduate in applied science from the University of Toronto. His first position was with the Dominion Bridge Company in 1910, and three years later he became assistant bridge engineer for the Canadian Government Railways at Moncton, N.B.

After the organization of the Canadian National Railways, he was named assistant engineer of standards at Toronto and then at Montreal. Later he served as engineer of bridge standards, assistant structural engineer and assistant engineer

R. O. Stewart, M.E.I.C.

of bridges. In 1942 he was appointed engineer of bridges, and in 1951 he was appointed assistant chief engineer of construction.

He has been associated with the Montreal terminal development, the North Sydney and Port-aux-Basques deep water terminals and the Strait of Canso causeway.

B. Wheelwright, M.E.I.C.

Barton Wheelwright was born at Minneapolis, Minnesota. He studied at Harvard University, receiving a master's degree in electrical engineering in 1911.

His railway work commenced that year with the Grand Trunk Railway, in Toronto, and he served in various positions with the Grand Trunk in Canada and New England until 1923. He joined Canadian National Railways in 1923, being appointed assistant to the chief engineer in Toronto in 1927.

He was engineer, maintenance of way for the Central Region of C.N.R. from 1936 to 1939, after which he was named the regional chief engineer. His appointment as system chief engineer of C.N.R. was received in 1945.

Alexander Campbell, M.E.I.C., recently appointed vice-president and manager of the Western Division of the Dominion Bridge Company Limited at Winnipeg, Manitoba, has announced changes in the personnel of the Division. Among

Alexander Campbell, M.E.I.C.

these appointments is that of E. A. Ford, M.E.I.C., as contract engineer, Western Division.

E. A. Ford, M.E.I.C., has been appointed contract engineer of the Dominion Bridge Company Limited Western Division.

Mr. Ford was first associated with this company in 1926 and after graduation from the University of Manitoba, joined the company as a draughtsman in 1927. Two years later he was made assistant to the chief engineer of plant and production, which position he held until 1932 when he was transferred to the Manitoba Bridge and Iron works. In 1936 he returned to the Dominion Bridge Company in the contract sales department and was assistant contract engineer from 1939 until his present appointment.

E. A. Ford, M.E.I.C.

F. Krug, M.E.I.C., has been appointed vice-president of the International Power Company Limited at Montreal, Que.

Mr. Krug was associated with the Porto Rico Railway, Light and Power Company from 1922 to 1936 and, in the

F. Krug, M.E.I.C.

latter year, he joined the Montreal Engineering Company of which he is now general manager. He has been a director of International Power since 1945.

Group Captain E. C. Luke, M.E.I.C., of the Royal Canadian Air Force, is serving with the NATO forces, for a period of about two years, located at Headquarters of the Allied Air Forces Central Europe at Fontainebleau, France.

He has an international staff of engineer officers, and his responsibility is the technical control and field inspection of the NATO airfield construction program in Central Europe. This area comprises France, Belgium, Holland, Luxemburg, and West Germany.

C. Marsan, M.E.I.C., has been appointed engineer in charge of the east section of the Streets Division of the Public Works Department of the City of Montreal.

Previously he was assistant engineer in the west section of the Waterworks and Sewers Division of the City of Montreal.

Graduating in 1934 from Ecole Polytechnique, he was employed several years by the Provincial Road Department until he joined in 1945 the Montreal Waterworks Division.

J. S. Campbell, M.E.I.C., professor of machine design at Queen's University has been elected to serve as chairman of the Kingston branch of the Institute.

Mr. Campbell obtained B.Sc. and

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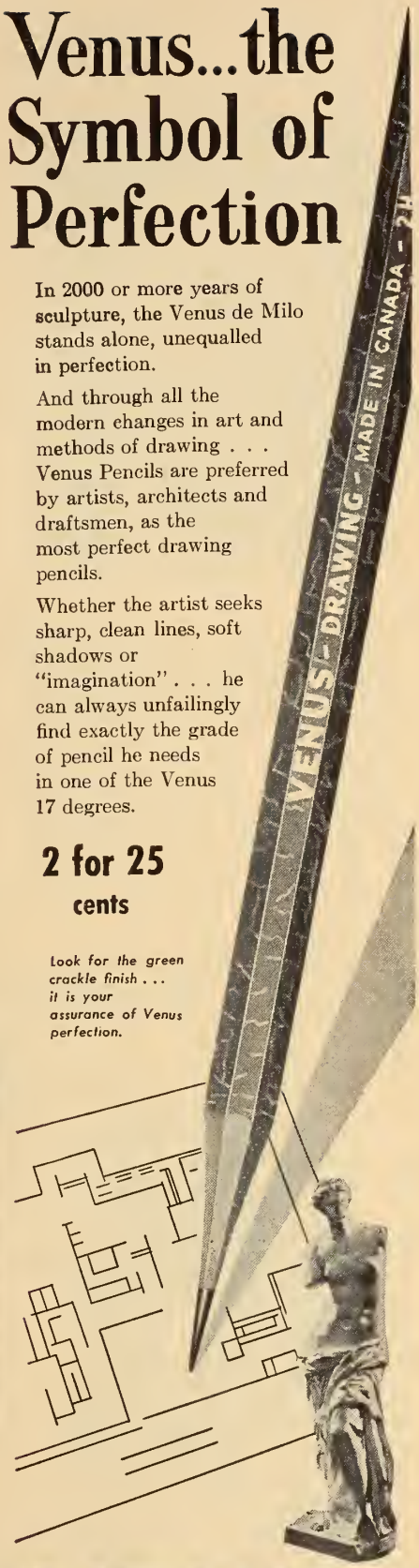

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M.Sc. degrees from Queen's University in 1931 and 1933 and his career has included service as supervisor of the pricing and routing departments of Massey-Harris in Toronto and superin-

J. S. Campbell, M.E.I.C.

tendent of the aircraft metal fittings division at Brantford, Ontario; work for D.I.L. in Montreal, and several years as chief engineer for Canadian Top and Body Corporation Limited at Tilbury, Ont.

Thereafter he worked for Kaiser Fraser at Willow Run, Michigan and York, Penn., as assistant chief engineer of the farm equipment division until taking his present position at Queen's. Most of his consulting work has been with Canadian Locomotive Company Limited as consultant to the vice-president of manufacturing.

W. D. G. Stratton, M.E.I.C., has been elected to serve as chairman of the Moncton Branch of the Institute.

Mr. Stratton is district airway engineer with the Department of Transport at Moncton, N.B.

He graduated in civil engineering from the University of New Brunswick in 1929 and then worked for several years with the Bell Telephone Company at Ottawa and Montreal. From 1934 to 1935, he was inspector of drilling and dredging with the Dominion Department of Public Works at Saint John, New Brunswick, and from 1936 he acted as resident engineer for the New Brunswick Highway Division.

In 1940 he joined the civil aviation branch of the Department of Transport at Saint John, N.B. as resident engineer, later becoming airways engineer at Moncton, N.B.

Erratum

In a June personal reporting the election of J. G. Shaeffer, M.E.I.C., as chair- of the Saskatchewan branch of the Institute, it was stated that Mr. Shaeffer entered the service of the Provincial Department of Health in 1937 and was appointed director of the division of sanitation in 1947.

More complete details of Mr. Shaeffer's career have now been received which state that he entered the service of the Provincial Department of Health as acting director of the Division of Sanitation in 1936 and was appointed director of the division in 1937.

Mr. Shaeffer also took post-graduate work at the University of Toronto and obtained his M.A.Sc. degree in 1947.

F. D. Greenwood, M.E.I.C., has left the Chromium Mining and Smelting Corporation Limited at Sault Ste. Marie, Ont. to join the staff of the Kilborn Engineering Company of Toronto.

Mr. Greenwood had been with the Chromium Mining and Smelting Corporation Limited since 1943; previously he worked as a designer draughtsman with the Hollinger Consolidated Gold Mines; with Vipond Consolidated Gold Mines and with Ford Motor Company of Canada.

Mr. Greenwood was secretary-treasurer of the Sault Ste. Marie Branch of the Institute in 1948 and was elected to serve as chairman of the Branch in March of this year; his new appointment however in Toronto necessitates his resignation from the Sault Ste. Marie Branch.

E. L. Neal, M.E.I.C., has been appointed mill manager in the Anglo-Newfoundland Development Company Limited.

Mr. Neal has been assistant general superintendent with the Anglo-Canadian Pulp and Paper Mills at Quebec. He graduated in mechanical engineering from Queen's University in 1938.

P. J. Lusser, M.E.I.C., is manager of the new Alberta Branch of Brown Boveri (Canada) Limited, at Calgary, Alta.

Mr. Lusser graduated in electrical engineering from the Federal Institute of Technology at Zurich, Switzerland, in 1944. He joined Brown Boveri in Baden, Switzerland and was attached

P. J. Lusser, M.E.I.C.

to their research and test laboratories. He worked in various engineering departments of Brown Boveri, mainly on equipment for thermo-electric plants. After a short period in the Company's technical office at Lausanne, Switzerland, he transferred to British Brown Boveri, London, England, in 1947, where he remained until 1951 in charge of mechanical and thermo-electric business.

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After returning to the Company's offices in Baden, he joined Brown Boveri (Canada) Limited, in 1951 at Montreal, Que.

As the Company's resident engineer in Western Canada, he will be available for technical assistance to Brown Boveri's representatives, Power and Mine Supply Company Limited at Winnipeg, and Gordon Russell Limited at Vancouver, B.C.

W. H. Hunt, M.E.I.C., is with Sir William Halcrow and Partners, of Accra, Gold Coast, British West Africa, where he holds the position of chief engineer for the Port of Tema.

A letter from Mr. Hunt appears in the "Correspondence" section of this issue of *The Journal.*

E. N. Gougeon, M.E.I.C., has left the Dominion Containers Limited to join Surveyer, Nenniger and Chenevert, consulting engineers, at Montreal, with the position of mechanical design engineer.

Mr. Gougeon joined the Dominion Containers Limited as a production engineer, later being appointed works manager; earlier he worked with Quebec Shipyards Limited at Quebec.

He graduated in mechanical engineering from the Massachusetts Institute of Technology in 1930.

A. H. Cole, M.E.I.C., safety engineer with the Canadian Car and Foundry Company Limited, Montreal, has been named chairman of the Quebec chapter of the American Society of Safety Engineers.

Mr. Cole joined the staff of the Canadian Car and Foundry Company Limited in 1941; previously he had worked with D. W. Ogilvie and Company in Montreal since his graduation in electrical engineering from McGill University in 1936.

C. S. Phelps, M.E.I.C., has been appointed manager of the Sarnia Hydro Electric System; he joined the Sarnia Hydro Electric System as assistant manager in 1949.

After graduating with a B.A.Sc. degree in electrical engineering in 1934,

C. S. Phelps, M.E.I.C.

he joined the Canadian General Electric Company Limited on a student's test course, and continued working with the Company in various head office divisions until 1942, when he left to join the Canadian Kellogg Company Limited on construction of the Polymer Corporation Limited. He remained as assistant electrical engineer at the Steam and Power Plant at the Polymer plant and was later promoted to electrical engineer of the Polymer plant.

R. W. Franklin, M.E.I.C., has recently been appointed senior structural engineer with Smith, Hinchman and Grylls Inc., architects and engineers at Detroit, U.S.A.

Mr. Franklin graduated from the University of Manitoba in 1942 in civil engineering.

During World War II, he served as a flying officer with the R.C.A.F. and after his release, he accepted the position of junior hydraulics engineer with the Water Resources Branch, Department of Mines and Natural Resources, Province of Manitoba at Winnipeg. In 1946 he joined J. Gordon Turnbull, Inc., consulting engineers of Cleveland, Ohio, as a structural engineer in connection with a factory being built in Lindsay, Ont. Later he went to Kansas City as a structural plan examiner for the Department of Public Works of the City. He has been with his present Company since 1950.

J. R. Carson, M.E.I.C., has joined the B.C. International Engineering Company Limited at Kemano, British Columbia.

He was previously a construction engineer for the Atlantic Construction Company at Halifax, N.S., and earlier worked for the National Harbours Board, at Halifax.

During the war, Mr. Carson served with the R.C.E. in Canada and overseas attaining the rank of major.

He is a graduate of the Nova Scotia Technical College, where he received a B.Sc. degree in civil engineering in 1935.

J. S. Korwin Gosiewski, M.E.I.C., has left H. W. Lea, consulting engineer at Ottawa, Ont., to become chief engineer with the Devoe Electric Switch Company Ltd., at Lachine, Que.

Mr. Gosiewski held the position of chief engineer at the head of the Ottawa office of H. W. Lea.

Previously, he was with the Aluminum Company of Canada Ltd., in Montreal and was a partner in the firm of Korward Wood Products Company, Montreal.

D. H. Johnston, M.E.I.C., has been appointed general supervisor, production, manufacturing section with the Electronics Equipment Department of Canadian General Electric Company at Toronto, Ont.

Mr. Johnston has worked with this Company for a number of years in the transmitter section of the Electronics division. He graduated in electrical engineering from Queen's University in 1941.

E. F. Gillies, M.E.I.C., has accepted a position as sales engineer with the Minnesota Mining and Manufacturing Limited of Canada, at Toronto.

Mr. Gillies was previously a traffic engineer with the Traffic Bureau, at Winnipeg, Man.

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M. S. Kennedy, M.E.I.C., has resigned as resident engineer with the Department of Public Works, Highways Division, at St. John's, Newfoundland, to accept the position as resident engineer with the Department of Public Works, in the construction branch at Victoria, B.C.

M. S. Lipovchak, M.E.I.C., is with the Canadian Chemical Company Limited at Edmonton, Alberta, and is at present on a training course at Rock Hill, South Carolina.

Mr. Lipovchak graduated in chemical engineering from the University of Zagreb, Yugoslavia, in 1945. Previous to joining the Canadian Chemical Company Limited, he was with the Canadian Aniline & Extract Company Ltd., at Hamilton, Ont.

D. S. McArthur, M.E.I.C.

D. S. McArthur, M.E.I.C., has accepted the position of production superintendent with Canadian Industries Limited, at their proposed polythene plant at Edmonton, Alta.

Mr. McArthur was previously an assistant plant superintendent at Dow Chemical, at Sarnia, Ont. He graduated in chemical engineering from the University of Alberta, in 1939.

A. R. Moffat, M.E.I.C., field engineer for H. G. Acres & Co., of Niagara Falls, Ont., has recently been transferred to the Bersimis River project, Saguenay County, Que. Mr. Moffat represented the same company on the construction of Beauharnois Power House No. 2, from 1949 to 1950.

D. O. D. Ramsdale, M.E.I.C., has recently been transferred from Toronto to St. Catharines, Ont., to the head office of the English Electric Company.

Mr. Ramsdale holds the position of manager of the Central Station Sales. He joined the staff of English Electric Company in 1940 and after service with the R.C.N.V.R. from 1942-45, resumed his employment with the Company.

He graduated from McGill University in 1933 and went directly into the electrical industry.

I. Barsky, Jr.E.I.C., is employed with the Ford Motor Company of Canada at Windsor, Ontario.

Mr. Barsky graduated in mechanical engineering from the University of Manitoba in 1950.

H. W. Chikofsky, Jr.E.I.C., has joined the staff of the Canadian S.K.F. Company Limited at Scarboro, Ont., as a plant engineer.

Mr. Chikofsky had previously been working as junior design engineer with the Abitibi Power and Paper Company Limited at Sturgeon Falls, Ont. He graduated in mechanical engineering from the University of Toronto in 1948.

J. C. Brodeur, Jr.E.I.C., is with Spencer, White and Prentis of Canada Limited, engineers and contractors, at Montreal, Que.

He had previously been with the Raymond Concrete Pile Company Limited at Montreal.

Mr. Brodeur graduated in civil engineering from Queen's University in 1950.

J. F. Clarabut, Jr.E.I.C., is at the Military College of Science at Shrivenham, in Wiltshire, England.

Lieut. Clarabut graduated in mechanical engineering from the University of Toronto in 1950 and has been at the Canadian Armament and Research Establishment at Valcartier, Quebec.

D. A. Brewer, Jr.E.I.C., is serving with the R.C.A.F. as a flying officer stationed at the R.C.A.F. station at Centralia, Ont.

He had previously been with the Aviation Forecast Office of the R.C.A.F. at Trenton, Ont. Mr. Brewer graduated in aeronautical engineering from the University of Toronto in 1950.

R. G. Brown, Jr.E.I.C., is with the surveys branch of the Department of Natural Resources at Regina, Saskatchewan.

Mr. Brown graduated in civil engineering from the University of Saskatchewan in 1950.

J. W. Clarke, Jr.E.I.C., has been transferred to headquarters of the Canadian National Railways in Montreal to the position of assistant engineer working on special problems in the chief engineer's office.

Previously, Mr. Clarke had been at Ottawa, Ont., as assistant engineer of the Ottawa Division. He graduated in civil engineering from McGill University in 1949.

J. Celmins, Jr.E.I.C., has joined the Catalytic Construction of Canada Limited at Sarnia, Ont., as party chief.

He had previously been working as a rodman and instrumentman with the International Nickel Company of Canada Limited at Copper Cliff, Ontario.

Mr. Celmins graduated from the Baltic University in Germany in 1947.

R. Denis, Jr.E.I.C., has left the Canada and Dominion Sugar Company Limited to join the city of Montreal Public Works Department in the water and sewerage division.

Mr. Denis graduated in chemical engineering from Laval University in 1948.

F. E. Eland, Jr.E.I.C., has left his position as field engineer with Ferrocon Limited to join the Abitibi Power and Paper Company Limited at Toronto, Ont.

Mr. Eland graduated with a B.A.Sc. in mechanical engineering from the University of Toronto in 1949.

E. A. Fischer, Jr.E.I.C., is employed by Underwood and McLellan and is working on land surveys in Saskatchewan. He had recently been working on the new water and sewer system at Flin Flon, Manitoba.

Mr. Fischer graduated from the University of Manitoba in civil engineering in 1950.

G. E. French, Jr.E.I.C., is assistant district municipal engineer with the Ontario Department of Highways at Bancroft, Ont.

Mr. French graduated in civil engineering from the University of Toronto in 1950.

R. A. Gilmour, Jr.E.I.C., is employed with the Canadian Westinghouse Company Limited at Ottawa, Ont.

Mr. Gilmour graduated in electrical engineering from the University of Manitoba in 1950.

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P. M. Gillespie, JR.E.I.C., has joined the Sheldon Engineering Company Limited at Galt, Ont.

Formerly, Mr. Gillespie was project engineer with the Dominion Textile Company at Montreal, Que. He graduated with a B.A.Sc. degree in mechanical engineering from the University of Toronto in 1945.

W. J. Hardstaff, JR.E.I.C., is with the Royalite Oil Company Limited at Kindersley, Sask.

Previously he was district engineer with the Saskatchewan Department of Agriculture in the conservation and development branch at Saskatoon, Sask.

Mr. Hardstaff graduated in civil engineering from the University of Saskatchewan in 1950.

R. T. Hill, JR.E.I.C., has been appointed acting chief building inspector with the Township of York at Toronto, Ont.

Mr. Hill joined the Township of York as junior design engineer in 1951; he graduated from the University of Toronto in 1950 in civil engineering and worked for a time for Defence Construction Limited at Petawawa, Ont.

H. E. Mahood, JR.E.I.C., has returned to the conservation and development branch of the Department of Agriculture at Saskatoon, Sask., after nine months in Logan, Utah, U.S.A. for postgraduate work in irrigation.

Mr. Mahood graduated in mechanical engineering from the University of Saskatchewan in 1949.

E. R. Magnusson, JR.E.I.C., is with the directorate of installation, H.Q., N.E.A.C,. as the Pepperrell Air Force Base, St. John's, Newfoundland.

Previously he was bridge inspector in the chief engineer's office of the Canadian Pacific Railway at Windsor station, Montreal, Que.

Mr. Magnusson graduated in civil engineering from the University of New Brunswick in 1948.

K. A. Mellish, JR.E.I.C., is a sanitary engineer with the Department of Health and Welfare in the public health engineering division.

Mr. Mellish graduated in civil engineering from the University of New Brunswick in 1950.

V. A. McGregor, JR.E.I.C., is with the Aluminum Company of Canada at Montreal, Que., working in the general engineering department.

Previously he was with the Dominion Tar and Chemical Company at Beauharnois, Que.

Mr. McGregor graduated in electrical engineering from the University of Manitoba in 1950.

L. LaRue, JR.E.I.C., is with the St. Regis Paper Company (Canada) Limited at St. Jean, Que., working in the engineering department of the Panelyte division.

Previously he was with the Provincial Government Health Laboratories in the division of chemical and sanitary control at Montreal, Que.

Mr. LaRue graduated with a B.A.Sc. degree in chemical engineering from Laval University in 1950.

P. Marcel Morency, JR.E.I.C., has been transferred from Toronto to Montreal with the Canada Wire and Cable Company, Limited.

Mr. Morency graduated in electrical engineering with a B.A.Sc. degree from Laval University in 1950.

I. E. McIntosh, JR.E.I.C., is employed by the Steel Company of Canada as a lubrication engineer at the Swansea Works.

Previously he was operating instructor with General Motors Diesel Limited at London, Ont.

Mr. McIntosh graduated in mechanical engineering from the University of Manitoba in 1950.

W. J. Robinson, JR.E.I.C., has left Walker and Associates at Hamilton, Ont., consulting engineers, to join the Provincial Engineering Company Limited at Niagara Falls, Ont.

Mr. Robinson graduated in electrical engineering from the University of Manitoba in 1949.

A F. Roberts, JR.E.I.C., is a mine engineer with the Giant Mascot Mines Limited at Spillimacheen, B.C.

Mr. Roberts graduated with a B.A.Sc. degree in mining engineering from the University of British Columbia in 1951.

J. F. Probert, JR.E.I.C., is working in the engineering division of the Imperial Oil Company at Sarnia, Ont.

Mr. Probert graduated in electrical engineering from the University of Alberta in 1950.

K. W. Stairs, JR.E.I.C., is with the directorate of installations at Pepperrell Air Base at St. John's, Nfld.

Mr. Stairs was previously a bridge inspector with the Bridge Department of the Canadian Pacific Railway at Windsor Station, Montreal, Que.

He graduated in civil engineering

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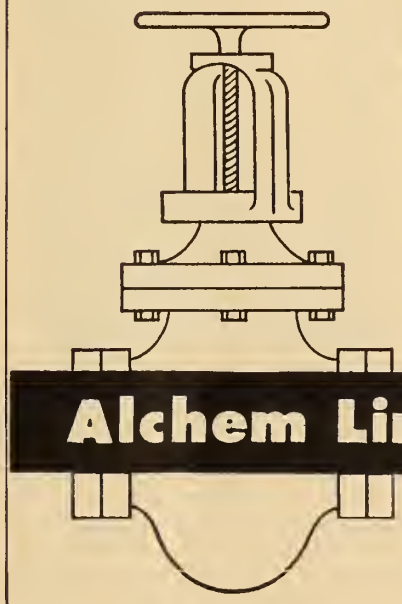

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from the University of New Brunswick in 1948.

David Townsend, JT.E.I.C., is employed by the Ontario Paper Company, at Heron Bay, Ont.

Mr. Townsend graduated from McGill University in civil engineering in 1948.

He was previously assistant engineer with the Eastern Rockies Forest Conservation Board at Calgary, Alberta.

R. R. Welwood, JT.E.I.C., is mine captain of the underground mine at Caledonia, operated by the Gypsum Lime and Alabastine (Canada) Limited.

He was previously with the Britannia Mining and Smelting Company Limited at Britannia Beach, B.C.

Mr. Welwood graduated in mining engineering from Queen's University in 1950.

W. J. De Coursey, S.E.I.C., (University of Alberta, chemical engineering, 1951) has been awarded the gold medal of the Association of Professional Engineers of Alberta.

J. S. Kennedy, S.E.I.C., (University of Alberta, civil engineering, 1951), has been awarded the gold medal of the Association of Professional Engineers of Alberta.

D. R. Duncan, S.E.I.C., (University of British Columbia, mechanical engineering, 1952), is with the Western Electric Company at South Kearny in New Jersey, U.S.A.

N. M. Engleman, S.E.I.C. (University of Toronto, civil engineering, 1951) is working with the Canadian Liquid Air Company at Montreal in charge of their development and engineering laboratory.

R. G. Foxall, S.E.I.C., (University of British Columbia, civil engineering, 1952) is a trainee with the Canadian National Railways, at Montreal, Que.

D. H. Jamieson, S.E.I.C., (University of British Columbia, civil engineering, 1951) is working as field engineer with the Dominion Bridge Company Limited, in the Pacific Division at Burnaby, B.C.

Morris Klein, S.E.I.C., is working with the Ford Motor Company at Windsor, Ont.

He was previously with the Northern Electric Company at Montreal, Que. Mr. Klein graduated in mechanical engineering from the University of Toronto in 1951.

H. E. Moller, S.E.I.C., (University of Manitoba, civil engineering, 1952) is employed with the firm of Underwood, McLelland and Associates of Saskatoon, Sask.

Y. Montcalm, S.E.I.C., (McGill University, electrical engineering, 1951) has left the Shawinigan Water and Power Company to join the Quebec Power Company, at Quebec.

C. C. Nicholson, S.E.I.C. (University of Saskatchewan, electrical engineering, 1952) is employed with the Canadian Westinghouse Company Limited at Hamilton, Ont.

Gilles Roy, S.E.I.C., (Laval University, electrical engineering, 1951), is chief electrical draughtsman with G. T. Davie and Sons, Limited at Lauzon, Levis, Que.

P. D. Shewchuk, S.E.I.C., (University of Manitoba, electrical engineering, 1951), is working with the Northern Electric Company at Belleville, Ont.

J. A. Smeltzer, S.E.I.C., (Nova Scotia Technical College, chemical engineering, 1952), is employed with the Canada Paper Company at Windsor Mills, Quebec.

S. D. Valentine, S.E.I.C., (University of New Brunswick), is working with the Atlas Asbestos Company Limited at Montreal.

W. A. Wolley-Dod, S.E.I.C., (University of British Columbia, civil engineering, 1951), has recently obtained his commission as an Alberta Land Surveyor and has entered a partnership with his former employer, R. McCutcheon, D.L.S., A.L.S., in Calgary, Alta.

Visitors to Headquarters

Garnet Page, Ottawa, Ont., June 23rd, 1952.

C. J. Connolly, M.E.I.C., Halifax, N.S., June 23rd, 1952.

E. W. Izard, M.E.I.C., Virginia, BC., July 2nd, 1952.

J. K. Young, Glasgow, Scotland, July 2nd, 1952.

John Graene, Manchester, England, July 2nd, 1952.

R. J. G. Scholfield, M.E.I.C., Bound Brook, N.J., U.S.A., July 7th, 1952.

E. M. Rensaa, M.E.I.C., Edmonton, Alberta, July 7th, 1952.

T. C. Main, M.E.I.C., Edmonton, Alberta, July 7th, 1952.

J. Tutecky, JT.E.I.C., Sturgeon Falls, Ont. July 7th, 1952.

E. E. Preston, London, England, July 11th, 1952.

E. P. Muntz, M.E.I.C., Hamilton, Ont., July 15th, 1952.

M. W. Huggins, M.E.I.C., Toronto, Ont., July 15th, 1952.

C. R. Borbun, Ottawa, Ont., July 15th, 1952.

C. McC. Henderson, Modesto, California, U.S.A., July 17th, 1952.

H. B. Kolm, S.E.I.C., Halifax, N.S., July 22nd, 1952.

Georg Hackman, Concord, Massachusetts, U.S.A., July 23rd, 1952.

Obituaries

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

Dr. Augustin Frigon, M.E.I.C., director of planning and research for the Canadian Broadcasting Corporation, died suddenly in the Laurentian resort town of Sixteen Islands on July 9th, 1952.

Born in Montreal in 1888, Dr. Frigon was educated at the Plateau Academy in Montreal. He studied engineering at Ecole Polytechnique where he graduated with honours in civil engineering in 1909. While a student, he was employed during the summer periods by the City of Montreal and by the Montreal Light, Heat and Power Limited. Immediately after receiving his degree in Montreal, he attended post-graduate courses in the field of electrical engineering at the Massachusetts Institute of Technology for one year.

After the first World War, he went to Paris to attend the courses of the well-known electrical engineering school "L'Ecole Supérieure d'électricité" and was awarded the degree of electrical engineer. He then studied at the "Sorbonne" faculty of the University of Paris for the doctor's degree which he received in 1922.

Dr. Frigon has had a prominent career in the field of technical and engineering education and in the practice of electrical engineering. At the time of his graduation from Ecole Polytechnique in 1909, he was appointed instructor in the electrical engineering department of the Ecole. He was in charge of the laboratories and later was appointed assistant professor of electrical engineering. In 1917 he was made full professor. In 1923 at the age of 35, he was appointed dean of engineering and as such, devoted himself principally to the improvement of teaching methods. He was a strong believer in sound scientific training as a basis for engineering education. Through constant improvement to the curriculum he emphasized the role of engineering as the application of the basic sciences. He was responsible for the installation of most of the applied science laboratories, the most important being those of hydraulics and of strength of materials which at that time were among the best equipped in the country. He contributed also in a very large degree to the development and to the many improvements made between 1920 and 1930 to the electrical engineering department. In 1935, he resigned as dean of engineering and became president of

the board of directors of Ecole Polytechnique.

In 1924 he was appointed director general of technical education of the Province of Quebec and he acted as such until 1935. During that period he was responsible for the considerable development of the technical and trade school system and founded vocational institutions in many parts of the province. In 1924 he founded the publication "Technique" which has remained up to the present time the official organ of the technical school world.

From 1924 to 1935 he was president of the electrical commission of the city of Montreal which was responsible for the design and construction of the underground power and communication distribution systems in the city.

From 1928 to 1930 he sat as a member of the Canadian Commission on radio broadcasting known as the "Aird Commission" and as such participated in the study of the broadcasting systems of many countries of the world. The only engineer member of this commission, he was committed to study the technical

Dr. Augustin Frigon, M.E.I.C.

aspects of the problem and in this capacity was responsible for a good share of the work which resulted in a report favourable to the formation of a state controlled radio network.

In 1934 he was a member of the "Lapointe Commission" appointed to investigate the rates of electric light and power in the province of Quebec and, a year later, when the provincial government, as a result of this investigation, formed the Provincial Electricity Board, Dr. Frigon was appointed president of this new commission. He resigned from this office in 1936 to become assistant general manager of the Canadian Broadcasting Corporation. He was made general manager in 1944 and in 1951, due to ill health, resigned to become director of projects.

Having been associated with the CBC since the very beginning of its existence, Dr. Frigon has been very closely connected with the development of radio broadcasting in Canada on a national scale. He has had the supervision of all the technical services and under his direction there were built a chain of nineteen powerful stations across the country. During the time of his association with the CBC in a managerial position, the number of employees increased from 157 to the present figure of 1,700 and the budget increased by $13,000,000. Other important achievements during that period are the overseas station at Sackville, N.B., and the installation of the new C.B.C. studios in the new Radio-Canada building in Montreal. Before he resigned as general manager in 1951, the design of the television networks for the Toronto and Montreal stations were completed.

Dr. Frigon's achievements were recognized by the late King George VI who in 1946 made him a Companion of the Most Distinguished Order of St. Michael and St. George.

He was an honorary doctor of science of the University of Montreal and, among his other numerous activities, he was a member of the National Research Council from 1923 to 1939; a member of the Board of Education of the Province of Quebec; member of the Board of the Catholic School Commission from 1929 to 1935; member of the Franco-Canadian Scientific Institute since 1926; director of the Canadian Information Service from 1945 to 1947. For many years he was honorary secretary for the province of Quebec of the Massachusetts Institute of Technology, and he was director of the Canadian Geographical Society.

Dr. Frigon joined the Institute as a Student in 1907, became an Associate Member in 1913 and Member in 1931. He attained life membership in 1931 and received the Julian C. Smith Medal in 1941. He was chairman of the Montreal Branch in 1934.

H. E. Brandon, M.E.I.C., of Toronto, Ont., died suddenly at his home on June 11th, 1952.

Mr. Brandon was born at Carmington, Ontario, in 1884. After graduating with a B.A.Sc. degree from the University of Toronto in 1907, he worked with the Manitoba Bridge and Iron Works and the Vulcan Iron Works in Winnipeg

H. E. Brandon, M.E.I.C.

until 1915. He was chief engineer with the latter firm. He then served with the Canadian Expeditionary Force in World War I with the rank of Lieutenant until 1919.

From 1919 until his retirement in 1950, he was structural engineer on the staff of the Hydro-Electric Power Commission. During the greater part of his services with the commission he was in charge of structural and mechanical engineering as applied to generating, transforming and distributing stations.

Mr. Brandon joined the Institute as an Associate Member in 1926 and became a Member in 1940. He was a past councillor, a past chairman of the Toronto Branch and a member of the Association of Professional Engineers of Ontario.

T. A. Wood, M.E.I.C., assistant chief inspector of boilers and machinery of the Department of Public Works, Government of British Columbia, died suddenly on June 13, 1952.

Mr. Wood was born at Victoria, B.C., in 1898 and served an apprenticeship in the Canadian Pacific Railway repair shop (Coastal Service) and subsequently served as chief engineer in Canadian National Steamships' deep sea vessels.

In 1927 he became an active partner in the firm of Murdie-Wood Engineering Works at Victoria. In 1936 Mr. Wood joined the B.C. Boilers and Machinery Inspection Department and was district inspector in the West Kootenay and Prince Rupert Areas until 1949 when he was appointed assistant chief inspector.

Mr. Wood was a registered professional engineer in British Columbia and became a Member of the Institute in 1947.

H. B. Hicks, M.E.I.C.—News has only recently been received of the death in Vancouver of Mr. H .B. Hicks on July 11th, 1949.

Born in St. Paul, Minnesota, Mr. Hicks attended the University of Washington. His early career was spent on survey work with the City of Seattle and on irrigation work in the Pacific Northwest. He joined the British Columbia Government Water Rights Branch in 1912 and, apart from overseas service with the Canadian Army during World War I, remained with the Branch until his retirement in 1933.

Mr. Hicks joined the Institute as an Associate Member in 1920 and attained life membership in 1942.

D. J. Urquhart, Jr.E.I.C., lost his life in an air accident on July 10th, 1952, while flying with the 402 Reserve Air Force Squadron in the Yukon Territories.

Mr. Urquhart joined the R.C.A.F. in 1942 and had an outstanding career in Bomber Command until his discharge at the end of World War II. He then completed his university education at the University of British Columbia, graduating with honours as a mechanical engineer in 1950. On graduation he joined the Canadian Westinghouse Engineering Apprenticeship Training Course at Hamilton, Ont., but before the two years was completed, he accepted a position as sales engineer in the Winnipeg district office in 1951.

While undergoing training at the Hamilton Works, Mr. Urquhart was awarded second prize by the Hamilton Branch of the Institute for an original paper on "The Gas Turbine as a Power Plant and Locomotive Prime Mover"

He joined the Institute as a Student in 1948 and was transferred to Junior in 1952.

G. L. Williamson, Jr.E.I.C., of Zealandia, Saskatchewan, died in Ottawa on October 13th, 1951.

Mr. Williamson graduated in electrical engineering from the University of Saskatchewan in 1950, after which he joined the inspection services of the Department of National Defence at Ottawa, Ont.

He joined the Institute as a Student in 1948.

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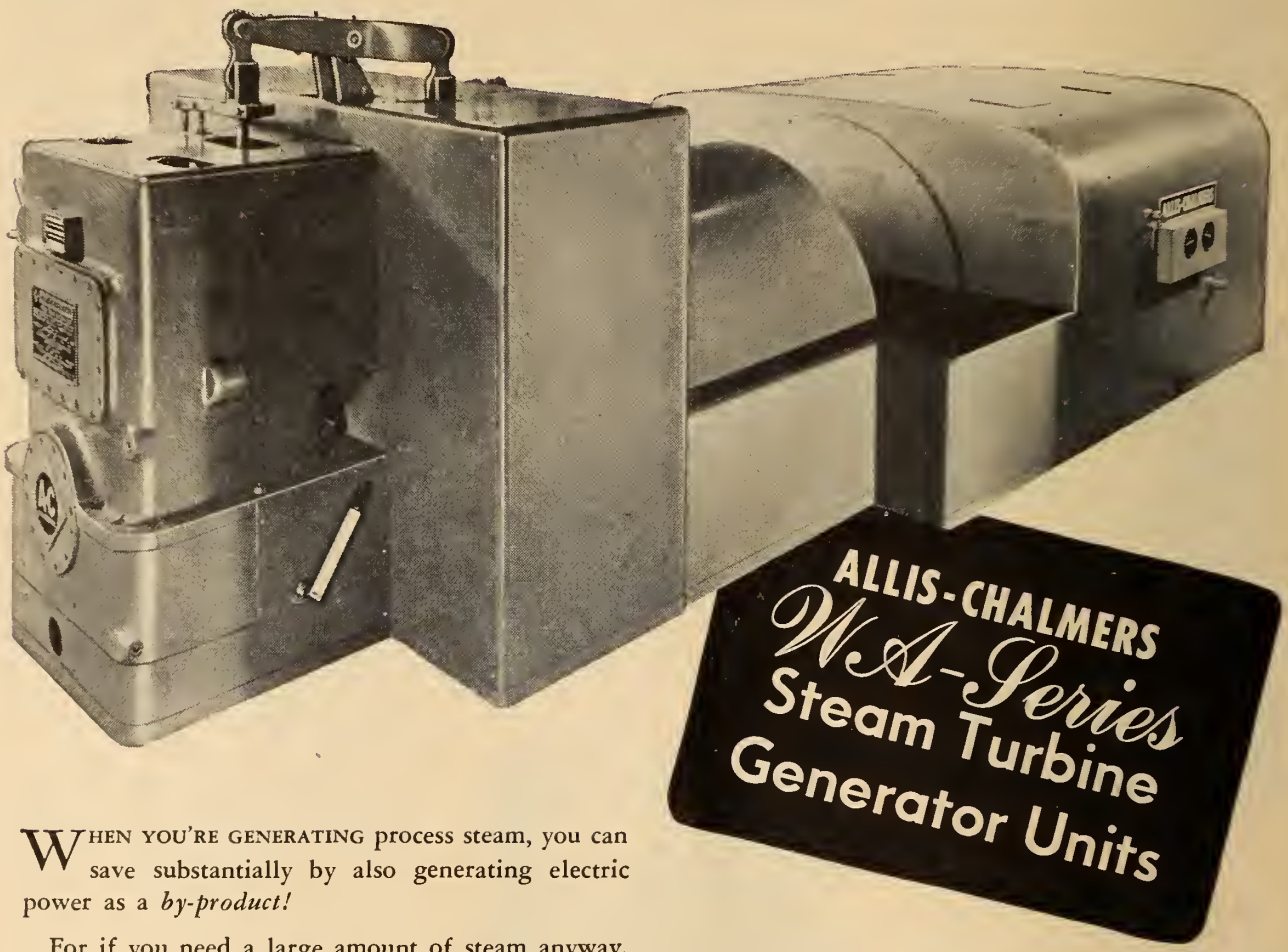

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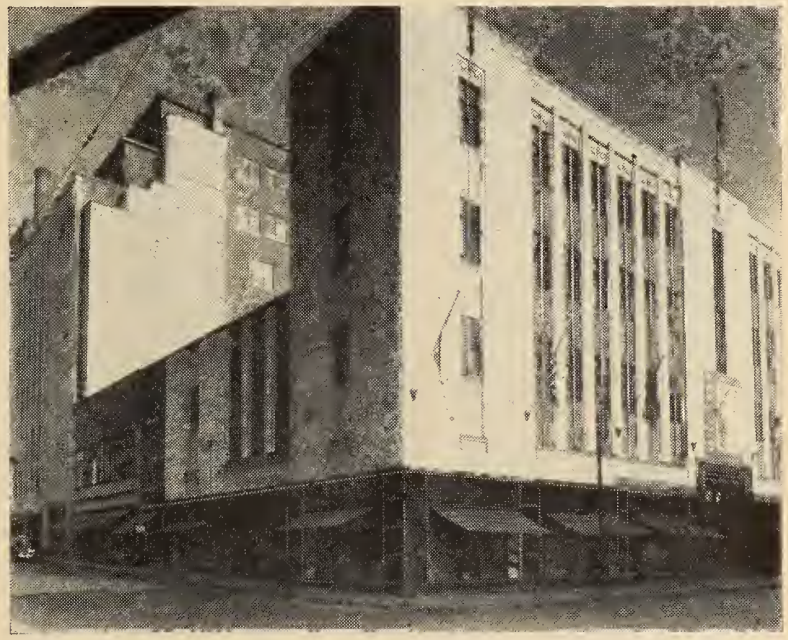

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Employment Service

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

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

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

Situations Vacant

CIVIL

CIVIL ENGINEER required by the Canadian Institute of Steel Construction. Applicants should be bilingual with a minimum of ten years' experience for the position of Eastern Representative of their body, with headquarters in Montreal. Applicants should state particulars of education and practical background. The selected engineer must be prepared to travel in Eastern Canada covering all of the Maritime Provinces, Newfoundland and Quebec. Applications will be treated as strictly confidential. Apply to File No. 4312-V.

FIVE GRADUATE ENGINEERS with not less than two years experience including some surveying, for work in field in Ontario and Quebec on heavy construction work. Apply to File No. 4322-V.

ELECTRICAL

TWO ELECTRONIC ENGINEERS for production design of radar equipment. Applicants should have 3 to 5 years experience preferably. Location Ontario. Apply to File No. 4309-V.

ELECTRICAL ENGINEER recent graduate, required by small manufacturer of power equipment for Montreal sales office. Previous experience in sales is desirable but not essential. Applicants must be bilingual. Apply to File No. 4315-V.

DEMONSTRATOR IN electrical engineering laboratories (circuits, electric machines, power) at the University of Toronto, for 1952-53 session. Apply to File No. 4327-V.

INSTRUCTOR OR JUNIOR lecturer for lecture and laboratory work in electric machinery and electric machine design at the University of Toronto, commencing with 1952-53 session. Apply to File No. 4327-V.

MECHANICAL ENGINEER

MECHANICAL ENGINEER preferably with a masters degree and background and interest in hydrodynamics. An interest in ship structures would be of value. Duties include responsibility for the planning of trials and the collection, analysis and reporting of essential data on the performance characteristics of novel designs of surface craft and for design of structural modifications as trials results show desirable. Apply to File No. 4307-V.

MECHANICAL OR METALLURGICAL engineer with sales background to take full responsibility for a new Ontario business of small, well established American company, manufacturing bearing metals. Apply to File No. 4308-V.

MECHANICAL ENGINEER with about 5 to 10 years experience of production experience on radar equipment. Location Ontario. Apply to File No. 4309-V.

MECHANICAL ENGINEER required for field work in Ontario. Applicant with not less than 3 years experience in the installation of machinery and other mechanical equipment. Apply to File No. 4311-V.

FOUR GRADUATE MECHANICAL engineers required for work in Montreal office and four senior draughtsmen. Applicants should not have less than 3 years experience in detailed design of high quality machinery parts. Apply to File No. 4311-V.

MECHANICAL ENGINEER to act as sales engineer for American manufacturer with new plant in Canada. Applicant should preferably be familiar with internal combustion engines and automotive type equipment. Territory between Windsor and Toronto. Apply to File No. 4314-V.

MECHANICAL ENGINEER required in Montreal to act as assistant works engineer. Applicant should have 5 to 10 years experience in industrial work. Apply to File No. 4320-V.

MECHANICAL ENGINEER required by paper mill located in Province of Quebec, preferably with two or three years experience. Apply to File No. 4323-V.

MECHANICAL ENGINEER required by organization in Ontario to work with shop superintendent on shop administration, scheduling and production control. Work primarily the fabrication of structural and heavy plate work and manufacture of wide variety of heavy equipment. Apply to File No. 4326-V.

MISCELLANEOUS

METALLURGICAL, ELECTRICAL, Mechanical or Chemical engineer required by metallurgical plant located in Province of Quebec for production department. Salary for 1952 graduate $300.00 per month, for graduates with one or two years experience the salary is open for discussion. Applicant should be bilingual. Apply to File No. 4310-V.

FIELD ENGINEER required by manufacturer of premium quality industrial power transmission V-setting and drives, full range of specialized industrial hose and other mechanical rubber goods throughout industrial, mining, lumbering, paper and construction markets. Qualifications: preferably graduate engineer with minimum 1 year selling experience, owner of serviceable car. Based centrally in New Brunswick or Nova Scotia. Age 23 to 40. Apply to File No. 4313-V.

SALES ENGINEER required by American manufacturer of industrial pumps, manufacturing in Canada. Territory Montreal and area. Age 25 to 35. Engineering degree and some experience in hydraulic field. Apply to File No. 4316-V.

ENGINEERS (grade 1 $2,970.00-$3,498.00) plus cost of living bonus of $907.00 per year, required by City of Montreal. Engineering or applied science degree from a recognized university, must be a member of The Corporation of Professional Engineers in P.Q. For further information apply to File No. 4317-V.

SANITARY ENGINEER Grade 3 ($4,290.00-$4,950.00) plus cost of living bonus $907.00 per year required by City of Montreal. Must have a degree in engineering or applied science from a recognized university and preferably experience in public health in matters of sanitation, preferably with a federal, provincial or municipal health department. For further information apply to File No. 4317-V.

A LEADING MONTREAL manufacturer of electronics equipment requires men with electronics design and development experience for an expanding program in the following fields, relay communications systems, VHF and UHF equipment, radar design and production, general electronics design and development. Please give full particulars of age, education and experience in reply. Apply to File No. 4318-V.

UNIVERSITY GRADUATE for research and development work on textiles for a Toronto research laboratory. Applicants should possess a degree in physics, chemistry or textile technology and have some experience in the field of cotton textiles. This position is suitable for a young man, preferably not over 30. Salary will be commensurate with qualifications and experience. Applications or requests for further information should state age and give full particulars of training and previous experience. Apply to File No. 4319V.

SALES ENGINEER required by manufacturer of heating, ventilating and air conditioning equipment. Starting salary of $4,000.00 plus commission arrangement would be considered. It is desired to find someone who can develop dealer outlets, dealer training in air conditioning survey work, and who can help prepare catalogues for specific items. A person around the age of 30 would be desirable, but age will not be considered a barrier. We prefer applications in writing stating previous experience, education and training, and if bilingual. Apply to File No. 4321-V.

DESIGN ENGINEER required by Montreal manufacturer of air conditioning equipment. Graduate engineer of American or Canadian University acceptable. One who is fairly familiar with air conditioning and refrigeration applications, and a person capable of making cooling load surveys, quotations, air conditioning design and installation supervision. The salary will vary with the amount of experience. For person with minimum two years experience, starting salary of $4,000.00. Greater amount would be paid for person with extra capacity. Apply to File No. 4321-V.

SENIOR VACANCIES exist in all branches of the profession with the Hebrew Institute of Technology, Haifa, Israel. For all further details apply to File No. 4324-V.

ENGINEERS REQUIRED by expanding operations in Ontario, interested in aircraft engineering, sheet metal work. Apply to File No. 4325-V.

ESTIMATOR WANTED by well established general contractors located in Montreal. Must be bilingual and fully experienced and be capable of taking complete charge of estimating department. Salary open. All replies held in strictest confidence. Apply to File No. 4330-V.

ENGINEERS-IN-TRAINING for B.C. Forest Service. Salary $271-$327. Graduation from recognized university civil or forest engineering, or registered as engineer-in-training with Association Professional Engineers B.C. Promotion to high grades made when full professional registration completed. Positions permanent, superannuation plan. British subjects, under 45 years unless ex-servicemen. Apply to File No. 4331-V.

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

CHEMICAL

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

CHEMICAL ENGINEER who has had considerable experience in an analytical chemical lab. required to take complete charge of a moderately sized chemical laboratory and do process control, inventory control and inspection work. Location Niagara Falls. Apply to File No. 4268-V.

UNIVERSITY, located in Ontario has opening in the department of chemical engineering. Applicant should be capable of initiating and directing research in the chemical engineering aspects of the pulp and paper industry and also share in the instructions of undergraduate class. Apply to File No. 4284-V.

GRADUATE CHEMICAL engineer with industrial experience to head chemical and industrial engineering section of a large company near Montreal. Knowledge of distillation, heat exchange, filtration and thermal processes are desirable. Proven abilities as a leader essential. Good salary with excellent prospects. Group and retirement insurance benefits operated. Apply to File No. 4294-V.

CIVIL

CHIEF ENGINEER required by heavy construction company with head office in Montreal. Candidates must be qualified engineers with long successful experience on major civil engineering works, with locating Canadian or U.S. contractors. Able to take full control of contracts estimate to final account. Experience on marine work an advantage. Apply to File No. 4265-V.

ESTIMATOR FOR steel fabricator in Edmonton. Experience: at least three years in taking off structural reinforcing and miscellaneous iron. State experience, salary earned and when available in first letter. Applicant enclose recent snapshot. Apply to File No. 4271-V.

CIVIL ENGINEER, familiar with modern methods of structural steel design, including indeterminate structures, welded and riveted, required in Quebec City. Permanent position. At least 5 years practical experience. Bilingual essential. Apply in French or English and state age, education, experience, references and salary expected. Apply to File No. 4283-V.

ELECTRICAL

ASSISTANT PROFESSOR of electrical engineering required by university located in the Maritimes. Teaching two or more specified subjects within the field of electrical engineering including laboratory instruction, member of faculty and other duties as assigned. Graduate of a university with one or two years post graduate training in an accepted industrial graduate engineers training programme or equivalent experience. Apply to File No. 4269-V.

ELECTRICAL ENGINEER required by University in B.C. to act as demonstrator for the session 1952-53 from Sept. 15 to May 31. Should be a University graduate in electrical engineering preferably under 30 years of age, with a knowledge of both electronics and power. Demonstrators are allowed to register for one post graduate course during the session if they so desire. Salary $2,000.00. Apply to File No. 4288-V.

ELECTRICAL ENGINEER required to act as advisor to the board of the Gal Oya development project in Ceylon on all matters relating to electricity including the erection of HT transmission lines, the purchase of necessary equipment, and general problems connected with distribution of electricity throughout the Gal Oya valley. Salary equivalent to those paid in Canada, plus a substantial tax free allowance. For further details apply to File No. 4291-V.

ELECTRICAL ENGINEER recent graduate required for position covering Maritime Provinces, work to consist of design, draughting and field work for automatic controls and signaling. Apply to File No. 4292-V.

ELECTRICAL ENGINEER recent graduate required by organization in Montreal. Applicant should have capabilities to check shop installations and make layouts in accordance with preliminary outlines from senior supervision, a basic knowledge of industrial electronics, control applications and draughting. Apply to File No. 4300-V.

MECHANICAL

MECHANICAL ENGINEER 1950 graduate who would be interested in doing development and design work on equipment both large and small for use in the explication of radioactive materials to industrial, medical, and research purposes. Location Ontario. Apply to File No. 4260-V.

GRADUATE ENGINEER, preferably Mechanical Engineering with 8 years or more of engineering and production experience in industry. Age range 30-40 years. Duties will be to activate and coordinate a programme for the improvement of manufacturing methods and facilities for several plants with the purpose of obtaining the most effective and economical operation. This will include improved operating methods, equipment, materials handling, plant layout and wage incentive, installations. Starting salary range is $7,400-$8,700 although it could be higher if the right man is found. There is a good opportunity for advancement. Apply to File No. 4280-V.

McGill University

McGill University requires graduate mechanical engineers in the department of mechanical engineering; qualified in the design field for full time appointment, instructors and demonstrators for seven months, from 1st of October, 1952. Apply to File No. 4329-V.

FIVE GRADUATE CIVIL ENGINEERS with not less than two years experience, including some surveying, for work in field in Ontario and Quebec on heavy construction work. Apply Manager, C. D. Howe Company Limited, 1421 Atwater Ave., Montreal, P.Q.

GRADUATE ENGINEERS, preferably mechanical engineering with 3 or more years of industrial engineering experience in industry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment, materials handling, plant layout, and other aspects of factory operation. He will also make time studies to establish production standards for wage incentive installations. The starting salary range is $3,750-$,300. There are good opportunities for advancement. Apply to File No. 4280-V.

MECHANICAL ENGINEER 1952 graduate required for newsprint mill in Province of Quebec. Good opportunity for man interested in learning pulp and paper industry. Salary $300.00 per month. Apply to File No. 4303-V.

MISCELLANEOUS

ASSISTANT CHIEF ENGINEER required by large and progressive company manufacturing pulp and paper products, offers excellent opportunity for assistant chief engineer. Will be located in Ontario, work includes development design construction and maintenance on multiple plant basis requiring extensive experience. Salary in line with responsibility. Reply in confidence to File No. 4259-V.

SOILS ENGINEERS experienced in soil mechanics and foundations engineering, are required by a rapidly expanding organization. Graduate soils work desirable. Location Montreal, but some travelling required. Salary open. Apply to File No. 4266-V.

CHIEF ENGINEER to take full and immediate charge of industrial office in Toronto. Applicant must process excellent background in tools, jigs, dies, and special machine designing and must possess qualifications of directing approximately 50 men and maintaining client relationship. Highest salary for like position in Canada, with a future unlimited. Apply to File No. 4272-V.

SALES ENGINEER required for permanent position by manufacturer in Quebec City. Salary, commission and expenses. Preferably French-Canadian who is bilingual. Apply to File No. 4274-V.

FIELD AND OFFICE ENGINEERS urgently required in connection with large construction programme in Eastern Canada. Excellent salaries. Write at once giving full background including present salary and salary expected. Apply to File No. 4273-V.

CONSTRUCTION ASSISTANT personnel manager required by company undertaking major construction programme in Eastern Canada. Under personnel manager directs entire personnel programme, including selection and processing of personnel, but is particularly charged with administrative functions such as establishment of procedures, classifications, and rates; review of promotions, problems covering employment agreements, leave, and pay. Qualifications: construction and personnel experience. Definite administrative ability. Salary open. Location St. John, N.B. Apply to File No. 4275-V.

YOUNG GRADUATE ENGINEER required by financial institution to make surveys of and write reports on industrial plants in the province of Quebec. Must be completely bilingual and preferably with some manufacturing experience. Permanent position, pension and insurance benefits. Salary according to qualifications. Apply to File No. 4277-V.

LARGE PETROLEUM marketing company in Eastern Canada requires the services of an experienced engineer to carry on research leading to producing and refining. Excellent opportunity for capable person. Replies in strictest confidence. Apply to File No. 4278-V.

CONSTRUCTION AND EQUIPMENT installation supervisor for newsprint mill to be erected in India. Applicant should have an engineering background and experience in mill construction and maintenance work and a working knowledge of mill operations from the process end will be helpful. Salary $12,000 per annum. Apply to File No. 4281-V.

METALLURGIST required by large organization in Montreal. Applicant will act as consultant for all materials used. Apply to File No. 4282-V.

ENGINEER REQUIRED by large organization in Montreal well versed in welding operations. Apply to File No. 4282-V.

GENERAL BUSINESS and production manager required to take complete charge of a large modern plant manufacturing plywood, flush doors and hardwood flooring. This is a senior position with salary in line with experience and responsibility. Reply in confidence giving full detail. Location St. Johns Nfld. Apply to File No. 4286-V.

SALES ENGINEER required by nationally known manufacturer. Must have design or construction experience with power or telephone utility. Excellent future for young engineer with sales aptitude and willingness to work. Location Montreal with considerable travelling involved. Knowledge of French an advantage. Salary open depending on qualifications. Satisfactory performance of duties would lead to promotion to district manager Eastern Canada within 3 years. Apply to File No. 4290-V.

INDUSTRIAL ENGINEER required manufacturer located in Province of Quebec. Applicant should be approximately 25 to 35 years of age, bilingual and preferably married. Apply to File No. 4293-V.

SALES ENGINEER required in Montreal for contacting municipalities and contractors. Equipment consists of water and sewage piping, concrete blocks. Applicant should be recent graduate and bilingual. Excellent opportunities offered. Apply to File No. 4295-V.

SALES ENGINEER required for heating and ventilation equipment. Must have established industrial sales contacts in Montreal area. Apply to File No. 4296-V.

PRODUCTION CONTROL supervisor required immediately, capable of administering a large department comprising of the following divisions: material control, production control, stores, receiving and plant material transport. Large manufacturing company located in central Ontario. Permanent position for one who has the necessary qualifications. Apply to File No. 4298-V.

ENGINEER REQUIRED by large manufacturing company in central Ontario to act as correspondent for the export department. Applicant must be capable of handling correspondence from South America and have some experience with this type of foreign trade. Apply to File No. 4298-V.

INDUSTRIAL ENGINEER required by firm of consultants located in Montreal. Applicant should be 30 to 45 years of age with experience in management consulting or in industry. Apply to File No. 4299-V.

GRADUATE ENGINEER required by large manufacturer in Ontario. Applicant should have some experience in general plant maintenance, problems and installations. Apply to File No. 4301-V.

ENGINEERING SALES ESTIMATOR, young man required by leading electrical manufacturer for estimating, quotations and sales correspondence for our department of industrial fans. Basic technical background required, excellent opportunity. Apply to File No. 4304-V.

MECHANICAL OR ELECTRICAL engineer, recent graduate, previous experience not necessary, required by railway in Ontario. Will be given progressive training in various departments as a foundation for future engineering position in the mechanical department. This railway is almost completely dieselized and this is an excellent opportunity for the right man. Apply to File No. 4305-V.

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate, interested in following employment in illumination. Apply to File No. 4306-V.

Situations Wanted

MECHANICAL ENGINEER, M.E.I.C., 7 years experience in production, research and development, design, testing, tool design of gasoline and diesel engines and small mechanisms for mass production. Available on month's notice. Western Canada preferred. Apply to File No. 83-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948), desires foreign employment in construction field. Four years experience on the location, construction and maintenance of highways and railroads both as engineer and foreman. Presently employed as resident engineer by contractors in railroad construction. Age 26, single. Apply to File No. 204-W

CIVIL ENGINEER and Land Surveyor, M.E.I.C., 26 years varied experience abroad and in Canada, in: railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey of layouts and locations. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. Apply to File No. 489-W.

CHEMICAL ENGINEER, B.Eng., McGill University, M.E.I.C., P.Eng., age 31, single, 7 years experience in development, control and production in pulp and paper industry. Presently employed in supervisory capacity. Desires responsible position with any organization located in vicinity of Montreal or Toronto. Apply to File No. 660-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec, Technical College, Stuttgart 1924, about 18 years experience in Canada in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area preferred. Apply to File No. 1862-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., 20 years experience includes approval and type test work; design of power and lighting layouts; electric and diesel electric railway work; heating and airconditioning contracting. Versed also in administration; cost estimating and accounting; sales. Desires position calling for any of the above experiences, especially if emphasis is laid on the practical execution of the assignments. Available on approximately one month's notice. Apply to File No. 2101-W.

MECHANICAL ENGINEER, available for responsible position offering opportunity as representative, plant or assistant engineer Experience includes design, construction and maintenance. Good working knowledge of French and German. Reply to File No. 2642-W.

CIVIL ENGINEER, B.Eng. (McGill '44), M.E.I.C., P.Eng., P.Q., Ass. Member C.P.P.A., 35, married, car, speak French. Experience: 3 years small tool manufacture; 18 months paper mill maintenance and construction; two years woodlands engineering for paper company on North Shore; over two years Assistant Woodlands Engineer for Paper company in Central Quebec (including six months as resident engineer on a development project on the North Shore); just completed contract with U.S. Geological Survey on ECA loan to Directorate of Colonial Surveys in East and Central Africa. Desire work in woodlands or construction, or other, in Canada or abroad. Apply to File No. 2896-W.

ELECTRICAL ENGINEER, B.Sc.E., P.Eng. (Ont.), 5 years experience in electrical manufacturing, internal control and technical sales. Desirous of improving present position with greater scope of responsibility. Presently completing M. Comm. course at Varsity at nights. Completed marketing and accounting and statistics. Apply to File No. 2975-W.

CIVIL ENGINEER, Jr.E.I.C., age 27, married, one child, desires position with responsibility, in sales promotion, and/or sales and design with a well established company. Five years varied structural engineering experience in wood, concrete and steel construction. Prairie Provinces or Ontario preferred. Apply to File No. 3340-W.

GRADUATE MECHANICAL ENGINEER with several years experience in operation of plant seeks change of position to one requiring initiation and ability to accept responsibility at the executive level. Location preferably Quebec province but would go elsewhere in Canada dependent on nature of position offered. Apply to File No. 3355-W.

CIVIL ENGINEER, M.Sc., M.E.I.C., A.M.I.C.E., P.Eng., age 40, with considerable experience since 1933 (including England, Canada and U.S.A.) in the design of reinforced concrete and steel structures (warehouses, factory buildings, power station, boiler houses, oil refinery plants, coal hopper and bunkers, gas plants, apartment buildings, schools, hospitals, steel mills, chemical plants, supersonic test building and other industrial buildings, bridges), river engineering, waterworks; also estimating and surveying. Seeks responsible position in Ontario or Quebec. Apply to File No. 3369-W.

CHIEF INDUSTRIAL production engineer, age 38, graduate engineer, British A.M.I. Mech.E., A.M.I. Prod.E. 1st class, C.G.C. (Honors), 24 years experience, apprentice trained, requires executive position. Diesel, automobiles, gearing machine tools, industrial consulting, covering a comprehensive field in all phases of works and production management with world famous companys. At present employed with well known Canadian company in the capacity of job engineer. Principals who can offer a highly responsible position with

REQUIRED FOR WORK IN MONTREAL OFFICE. Four graduate mechanical engineers and four senior draftsmen with not less than three years experience in detailed design of high quality machinery parts.

REQUIRED FOR FIELD WORK IN ONTARIO. One graduate mechanical engineer with not less than three years experience in the installation of machinery and other mechanical equipment. APPLY TO: Manager, C. D. Howe Company Limited, 1421 Atwater Avenue, Montreal, Que.

genuine prospects of advancement, commencing salary being of secondary importance, apply for further particular to File No. 3617-W.

YOUNG MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., single, over 5 years design experience in process industries (mostly pulp and paper), power and construction, desires a responsible position offering a genuine opportunity for initiative and advancement. Available on two weeks notice to present employer. Personal interview by appointment. Montreal preferred. Apply to File No. 3777-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I. Mech.E. (G.B.), M.E.I.C., P.Eng., 20 years experience in development various types high speed I.C. engines (carburettor, diesel, petrol-injection, supercharged, etc., from 20-1,000 H.P.). At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. Apply to File No. 3863-W.

CIVIL ENGINEER, University of Saskatchewan, 1951, Jr.E.I.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

YOUNG ENGINEER, S.E.I.C., B.A.Sc., chemical engineering, fully bilingual, desires position around Montreal, either in sales or in design. Very interested in the heating and ventilating field and also possessing some industrial experience. Apply to File No. 3928-W.

ELECTRICAL AND MECHANICAL ENGINEER, Jr.E.I.C., fluently bilingual; seeks position as maintenance or assistance plant engineer in: textile or paper mill; oil or chemical industry; electric power station. 3 years previous experience as project engineer and field work supervisor in: heating, air conditioning, piping, thermo electric power stations. Apply to File No. 3945-W.

ELECTRICAL ENGINEER, S.E.I.C., B.Sc., 1948, M.Sc., 1950, age 26, married. Two years experience in responsible position with public utility. Experience includes distribution, land survey, drainage, sign and construction, hydro-electric power generation and transmission, street lighting, estimating and system appraisal. Desires position in Western Canada. Available October 1st. Apply to File No. 3946-W.

CIVIL ENGINEER, U. of T. 1935, M.E.I.C., P.Eng. of Ontario. Desires position of Planner with a municipality, industrial concern or consulting firm. Experienced in design and construction of sewage and water systems, roadwork, power distribution, land survey, drainage, housing layout and town planning. 5 years Naval service on armament building design and construction. Discharged with rank of Lt.-Commander. Last 3 years associated with R.C.A.F. in civilian capacity, engaged in layout of buildings and design of services for defence projects across Canada. Apply to File No. 3947-W.

ELECTRICAL MECHANICAL ENGINEER, S.E.I.C., 1951 graduate, age 27, single, fluently bilingual, completed G.E. Test Course with summer experience as electrician. seeks employment for position leading to plant or maintenance engineer, in large or medium size plant located in Montreal. Salary expected $300. or better, will be available June 2nd. Apply to File No. 3948-W.

CIVIL ENGINEER, M.E.I.C., available for part time work Montreal area. Concrete, structural steel, timber designs, detailing, qauntity take off, inspection service, etc. Available for short periods or other suitable arrangements. Apply to File No. 3949-W.

MECHANICAL ENGINEER, Jr.E.I.C., Queens 1948, R.C.A.F. veteran, age thirty-one, married. Four years experience in basic heavy industry in supervisory production position. Available July or before if required. Apply to File No. 3950-W.

MECHANICAL ENGINEER, age 29, British-Hons. B.Sc. (Glasgow); Assoc. R.T.C.; M.S. (Illinois); A.M.I. Mech.E. Experience includes: student apprentice, 2 years Air engineering officer, Royal Navy, in charge of maintenance work-shops, 3 years college lecturing at under-graduate level in heat engines and mechanics, 5 years varied research experience including lubrication, wear and strength of materials. At present employed as research engineer in U.S.A. —desires suitable position in B.C. with expanding company where pleasant personality and intelligent application of engineering principles required. Apply to File No. 3952-W.

CIVIL ENGINEER, age 26, British, B.A. (Hons.) Cambridge. Desires position in British Columbia with Civil Engineering firm or construction firm to work preferably in field but not necessarily. Experience: as student apprentice, 2½ years in Royal engineers as 2nd.-Ltd. training recruits in bridging, roads, etc., 1½ years as Junior Design Engineer in County Dept. of Public Works in U.S.A. At present employed by firm of civil engineers and land surveyors in U.S.A. Apply to File No. 3953-W.

Jr.E.I.C. GRADUATE would undertake on part time basis calculations, quantities and drawings of structural design, reinforced concrete, underpinning, soil mechanics and stabilization, sewerage and sewage disposal, water supply. Apply to File No. 3954-W.

MECHANICAL ENGINEER, P.Eng., M.E.I.C. Married, presently employed. Over 25 years in pulp and paper industry. Supervising experience on design, installation and maintenance. Familiar with manufacturing methods. Desires responsible position with consultants, mills or manufacturers. Apply to File No. 3956-W.

CIVIL ENGINEER, B.S.E., University of Michigan, Canadian citizen. Varied experience in estimating and project management, some purchasing with medium size contractor. Desires similar work in Montreal, Ottawa or Hamilton area. Apply to File No. 3960-W.

MECHANICAL ENGINEER, Jr.E.I.C., McGill 1950, recently completed two years graduate student engineering course with a large electrical manufacturer. Primarily engaged in plant layout, plant engineering and methods. Age 32, married, ex-naval officer seeks employment in manufacturing, preferably with a smaller company. Apply to File No 3961-W.

PART TIME WORK desired by graduate electrical engineer, power option. S.E.I.C., P.Eng. (Ontario). Evenings and week-ends in Toronto. Experienced in wiring design and lighting layout work. Apply to File No. 3962-W.

MECHANICAL ENGINEER, Jr.E.I.C., N.S.T.C. 1949), single, age 26, two years experience in technical and engineering departments of large Canadian chemical firm and one year in the pulp and paper industry. Desires employment in industrial engineering work. Apply to File No. 3966-W.

ELECTRICAL ENGINEER, U.B.C. 1947. Jr.E.I.C., P.Eng., age 28. Experience: one year test course, three years design and manufacture of control equipment, one year abroad in design office of a public utility. Desires responsible position. Available immediately. Apply to File No. 3967-W.

CHEMICAL ENGINEER, Graduate of University of Toronto, 1950. Married, presently employed by nationally known firm in the industrial engineering field. Interested primarily in position in either production or sales in Eastern or Western Canada, Western Canada preferred. Desires only a position where hard work and initiative will bring advancement. Available on short notice. Apply to File No. 3968-W.

QUALIFIED ELECTRICAL and mechanical engineer, aged 28, M.E.I.C. Graduate of the institution of Electrical Engineers, Graduate of the Institution of Mechanical Engineers, U.K. Imigrating to Canada in June, 1952, experienced in organizing and supervision of electrical transmission schemes up to 132KV. Also general industrial electrical installations. Seeks opportunity preferably with consultant, contractor or supply company but prepared to consider work in any field of electrical or mechanical engineering anywhere in Canada. Any reasonable offer considered. Apply to File No. 3969-W.

GRADUATE CIVIL ENGINEER, Jr.E.I.C., 5 years experience in pulp and paper industry covering design, construction and plant engineering. Also experience in technical and economic evaluation of new developments for management and supervision of small project staff. Desires broader opportunity in pulp and paper or chemical field. Location irrevalent. Apply to File No. 3970-W.

CHARTERED MECHANICAL ENGINEER British subject holding major English qualifications is now available in Toronto and is anxious to contact Canadian Principals with a view to taking up a permanent position at the earliest possible moment. Twelve years practical executive experience in the layout and equipment of large shops, garages and depots. Accustomed to the control of administrative, technical and shop staffs. Considerable experience of both design and estimating of all such equipment and services, including shop layout, pipe services, conveyors, cranes and other lifting equipment. Fullest knowledge in the preparation of specifications and reports, accustomed to dealing with purchasing staffs in conection with the placing of contracts. Highest references from Canadian and English executives to those interested. Apply to File No. 3974-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 honour graduate, one year's training in administration and supervisory work, and one years experience in design of conveying equipment. Interested in design or production work, and also in employment in plant engineering or materials handling departmeint of production organization. Available on short notice. Location irrelevant. Apply to File No. 3975-W.

MATHEMATICIAN, age 40, German, recently immigrated, Dr. rer. nat. Technical University Berlin, more than 10 years activity in responsible industrial, governmental, and University positions. Good experience in all branches of numerical analysis, in mechanics (ballistics, aerodynamics) and in theoretical physics. Various scientific publications. Own computing machine. Desires position in industrial company or research institute where mathematical knowledge and abilities are required. Willing to accept starting position with future possibilities. Available immediately. Apply to File No. 3977-W.

PHYSICIST, German, age 49, married, 4 children, 1930 promoted to Dr. phil. in physics at the University Leipzig (Germany). Presently located in Canada. Sound knowledge in experimental physics and mathematical calculation of the measurements. Worked as physicist for research work and development. Desires starting position in Physical laboratory, research work, test or instrument engineer. Prefer cable, metallurgical, or chemical industry anywhere in Canada. Available immediately. Apply to File No. 3978-W.

TWO YOUNG CIVIL engineers presently located in Montreal with six years' experience in reinforced concrete and steel construction, desire part time employment (evenings and week-ends) doing calculations and drawings. Apply to File No. 3979-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc. Manitoba 1944. Age 29, married, two children, veteran R.C.A.F. Extensive experience in design of reinforced concrete and foundations; plant layout and mechanical design in mining, chemical, and paper industries; checking field construction and estimating. Desires a position as plant engineer or with a consultant, preferably in Ontario. Apply to File No. 3980-W.

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

SALES ENGINEER OR MANAGER, P.Eng., M.E.I.C., A.I.P.E., B.A.Sc. (Mechanical), Toronto 1943, age 32, married, presently in Ottawa but free to locate anywhere and willing to travel Fourteen years total training and experience, last seven with same employer, last three as district manager in charge of all operations. Accustomed to dealing with executives, professional people and federal government officers. Desire to represent manufacturer of specialty mechanical and electrical equipment or related work. Apply to File No. 3982-W.

ENGINEER, M.E.I.C., P.Eng., 30 years experience with competent designers and detailers associated, specializing in the

efficient preparation of preliminary studies, designs, detail drawings, specifications and supervision of construction for small and large industrial buildings and miscellaneous structures. Desires to act as consulting engineer for individual parties or companies requiring industrial building development in the Maritimes, and Eastern Canada. Apply to File No. 3983-W.

ELECTRICAL ENGINEER, Jr.E.I.C., graduated 1950 desires employment with responsibility and opportunity. One year's experience in power apparatus sales, including substation layouts; 4 years as radar officer in R.C.A.F.; 5 years in telephone industry including both inside and outside maintenance and equipment engineering work. Married, age 31. Apply to File No. 3984-W.

CIVIL ENGINEER, S.E.I.C. (McGill '52), desires to work for a contractor or a consulting firm doing concrete or structural design of buildings. Apply to File No. 3988-W.

PLANT ENGINEER'S POSITION WANTED, M.E.I.C., 37 year old maintenance supervisor of a chemical industry desires more responsibility and scope. Have had special experience in labour controls and preventive maintenance which produced a substantial reduction of costs. Engineering background is mechanical and electrical. Desire position paying upper level of professional engineers of Ontario grade V, salary schedule. Apply to File No. 3989-W.

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

B.SC., A.M.I.E.E., English, age 27, emigrating to Canada later this year, desires post in which initiative and ability may be exercised. 8 years' experience design and development electronics, cables, transformers and mercury pool rectifiers. Some sales experience. Past 2 years spent on application of mercury pool high frequency inverters to induction heating for both forging and melting of metals. Location not important. Apply to File No. 3995-W.

ELECTRICAL ENGINEER, University graduate, 40, British, A.M.I.E.E., desires progressive position in Canada. Good education, wide general knowledge, experience and testing of electrical machines, plant maintenance, electric traction, operation of thermal and water power stations, commercial operations and in particular organization and administration of electric utility. Adaptable, widely travelled, fluent French and several other languages. Apply to File No. 3997-W.

AGRICULTURAL ENGINEER, M.E.I.C., Sask. 1943. Experience includes production, maintenance and plant expansion and construction. With D.I.L. one and half years, large food processing firm five years and dehydration firm three years. Available on short notice. Desires position with greater responsibilities and good future. Apply to File No. 3998-W.

CIVIL ENGINEER, M.E.I.C., commissioned Dominion Land Surveyor, soon to be retired from the federal civil service, graduate of Queens 1914, feels thoroughly fit for many more years service, in a supervisory capacity. Experience of over 40 years in the surveying profession, comprising legal and subdivision surveys: mapping by plane table and aerial photographs; road construction and townsite layouts; extensive knowledge of computing ground control for aerial mapping and reconnaissance. Apply to File No. 3999-W.

GRADUATE ENGINEER, B.Eng., S.E.I.C. (mining), McGill 1951, age 28, married, presently employed as layout engineer with large base metal mining company, seeks opening where initiative, capability and ambition would lead to position of technical or supervisory responsibility. Experience includes three years R.C.A.F., two summers military engineering (roads and bridges), varied experience in surveying, both topographic and underground, and underground mining. Presently enrolled in business management course, LaSalle Extension University. Interested in administration, report writing, planning. Apply to File No. 4000-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc., University of Alberta 1948. P.Eng., age 31, 2 children. 2 years industrial training course, 1 year engineering on specification of materials and processes, 1 year engineering on automatic home laundry equipment. Would like to return to Alberta or Western Canada. Interested in all phases of engineering including manufacturing, sales and service work. Apply to File No. 4001-W.

CIVIL ENGINEER, M.E.I.C., graduate 1949. Age 27, married, one child. Desires position with opportunity for experience and advancement, preferably in Western Canada. 3 years varied experience in design and construction. Apply to File No. 4002-W.

PART TIME WORK, desired by civil engineer, M.E.I.C., evenings and week-ends in Montreal. Experienced in structural design: reinforced concrete, steel, wood. Calculations and drawings. Plant layouts. Apply to File No. 4303-W.

Attention, Members

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

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

Newfoundland

B. E. Higgins, Jr.E.I.C.,
Secretary-Treasurer

Annual Meeting

The annual meeting of the Newfoundland Branch was held at the Newfoundland Flying Club, Torbay Airport, on Thursday, May 8, at 7.00 p.m. Approximately 35 members sat down to a very delicious turkey dinner served by the staff of the Flying Club.

The first item of business following the dinner was the presentation of prizes to two engineering students of Memorial University. These prizes were awarded at the students' night in April when students from the University presented two interesting papers. First prize of $25.00 was awarded to Mr. Lloyd Moores for his paper entitled, "How to Take Better Pictures". Second prize of $10.00 went to Mr. J. R. Wells for his paper "Engineering Aspect of the Fresh Fish Industry".

Annual reports of the various committees were presented, Mr. J. W. Morris reporting on the Membership Committee. He showed that 16 members and 3 Juniors were admitted to the Branch since the Annual Meeting in 1951. This brought the total membership of the Branch to date, to 132.

The reports of the Program and Entertainment Committees, given by Messrs. G. W. Cummings, S. J. Carew and C. H. Conroy showed a very successful season. The year's activities began at Woodstock Country Club on September 19, when the special speaker was Dr. Ira P. Macnab, president of the Engineering Institute. Monthly meetings followed, and on February 18, a very successful dance was held at the Old Colony Club. It is hoped that this will be an annual Branch affair.

The report of the treasurer, given by Mr. Brian Higgins, indicated a healthy financial condition. Following the reports of the committees Mr. E. L. Baillie and Mr. H. Forbes-Roberts outlined to the members the history of the Newfoundland Branch since its inception a little more than two years ago, and pointed out the great strides that have been made since then.

The retiring chairman, Mr. B. Monkman, expressed his thanks to the members of the executive and to all members of the Branch for their excellent co-operation during the past year. He also conveyed his thanks to the Engineers Wives' Club for catering at the socials following the monthly meetings and for the enjoyable party they tendered their husbands at the Flying Club in April.

The election of officers for the ensuing year resulted as follows: Chairman, S. J. Carew; vice-chairman, J. M. Hopkins; Executive officers, D. L. Cooper, E. Dickinson, J. P. Henderson, B. E. Higgins, G. B. Knight; Councillor, J. W. Morris; Immediate past-chairman, B. Monkman.

Mr. S. J. Carew then took the chair. He thanked the members for their confidence and outlined briefly a few suggestions for the coming year's programs. The meeting adjourned at 10.00 p.m.

Saguenay

W. A. Armstrong, Jr.E.I.C.,
Secretary-Treasurer

S. T. Solinski, Jr.E.I.C.,
Branch News Editor

Technical Meeting

On May 20, Dr. Barnett F. Dodge of Yale University, presenting a very interesting and informative paper on **Tonnage Oxygen,** traced the history of oxygen from Priestley's discovery of the element to the modern manufacturing processes.

The first commercial process, known as the Brin Process, was developed in 1880. This employed the decomposition of barium oxide to produce oxygen. A second method, in which oxygen is obtained as a by-product in the electrolysis of water, requires too much power to be economical. A third method, involving the rectification of liquid air, was developed simultaneously in France by Claude and in Germany by Linde, and this is the process which accounts for the large tonnages produced today.

Dr. Dodge reviewed a few of the many uses of oxygen, including the gasification of solid fuels, the continuous production of synthetic gas from coal or natural gas, synthesis of ammonia, the production of liquid fuels (Fischer-Tropsch process), the production of methanol and higher alcohols, chemical oxidation processes, the roasting of sulphide ores, and steel manufacture.

In the present commercial production process, the small amounts of argon, carbon dioxide, dust and water vapour must be removed from the air along with the nitrogen. The main steps in the process are (i) the removal of carbon dioxide and dust by washing with caustic soda, (ii) compression, (iii) removal of moisture, (iv) cooling to low temperature in heat exchangers, (v) liquefaction by expansion in the rectifying column. Efficiency of the best modern processes is 14-15 per cent from 95-98 per cent oxygen. The energy consumption in the process is 300-350 kw. per ton of oxygen produced.

The lecture was followed by a question period, and Dr. Dodge was thanked by Mr. B. L. Davis, Chairman of the Branch.

Field Trip

On May 24, 1952, about thirty-five members of the Branch visited the woodlands' operations of Price Brothers and Company. Included in the tour was a visit to the Chute des Georges Power Development on the Shipshaw River.

Annual Party

On May 31, 1952, about seventy-five couples enjoyed the last event of the year, the annual mixed party, held at the Saguenay Inn.

The evening included cocktails, dancing, and supper, and all in attendance reported a high degree of success. This event has come to be marked as the highlight of the Branch year, particularly by the members' wives, and has become established as a regular part of the program.

St. Maurice Valley

D. G. Demianiw, Jr.E.I.C.,
Secretary-Treasurer

Annual Meeting

The annual meeting of the St. Maurice Valley Branch was held on May 28, 1952, at the Hotel Chateau de Blois at Trois-Rivieres.

Mr. D. E. Covey of Trois-Rivieres was elected chairman for 1952-53 while Mr. L. A. Robillard of Shawinigan Falls was elected vice-chairman. New members of the Executive Committee for a two-year term beginning May, 1952, are Mr. A. H. Hubley of Trois-Rivieres, Mr. J. O. Kelly of Shawinigan Falls, and Mr. J. M. Jopp of La Tuque.

Mr. C. M. Yoshida of Trois-Rivieres was appointed secretary-treasurer.

Mr. J. F. Wickenden commented briefly on his impressions of Western Canada, obtained during his attendance at the annual meeting of the E.I.C. held at Vancouver during early May, 1952.

Guest speaker for the meeting was Mr. G. Jenkins of the engineering department, Carbide and Carbon Chemicals Division of Union Carbide & Carbon Corp., South Charleston, W. Va., U.S.A., who spoke on **Objectives of Water Pollution Control.** Mr. Jenkins was introduced by Mr. W. C. Heidenreich, works manager of Canadian Resins and Chemicals Ltd., Shawinigan Falls.

In his address, Mr. Jenkins outlined the fundamental objectives of water pollution control and stressed the necessity for preventing overemphasis and wasted effort in unprofitable action. Bodies of water, as well as the atmosphere, should

(*Continued on page 889*)

LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Electrical engineering: the theory and characteristics of electrical circuits and machinery, 6th ed. C. V. Christie. Toronto, McGraw-Hill, 1952. 675 pp., illus., $9.95.

The fact that this is the sixth edition of a work originally published in nineteen hundred and thirteen, is a self-evident proof of its value.

The nature of the information contained in this volume will be familiar to most of our members, namely, foundation material for lecture courses for junior and senior students in electrical engineering. Nothing has been taken from this edition, but much information has been added.

Some important circuit theorems have been included with the alternating current circuits.

Many more types of direct current machines are discussed, and the main systems of speed control have been included in the treatment of the polyphase induction motor.

The inclusion of numerical examples with the information on system faults and system stability has considerably enhanced the value of this section, and the material on mercury arc rectifiers has been brought up to date, although lack of space prohibited the inclusion of any other types of rectifiers.

The physical make up and arrangement we would like to draw to the attention of those of our members who are not familiar with the volume. Each change of subject is a new numbered paragraph. These numbered paragraphs are all listed in the table of contents, under their assigned chapters. The index at the back lists them all alphabetically. This combination provides both a classified and alphabetical directory to the whole subject, which is most useful, either for quick reference or for study.

To many of our readers, Professor Christie will be a familiar figure, both as a member of the Engineering Institute of Canada, and as Professor of Electrical Engineering at McGill University. Also, to those of you who may not already know, he has just been appointed professor emeritus of Electrical Engineering for this same department. It is particularly fitting that the sixth edition of ELECTRICAL ENGINEERING should appear just at this time. E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Chemical calculations: an introduction to the use of mathematics in chemistry. S. W. Benson, New York, Wiley, c1952. 217 pp., illus., $2.95. ($3.50 Canada).

This book is intended for the students who plan to continue the study of chemistry and for others who may be expected to master chemical calculations in one year. Its main object is to help overcome the difficulties of applying mathematical reasoning to chemical problems. Terms, units and definitions are arranged, whenever possible, in the form of equations. The subject matter is presented in such a way that the student may constantly check his own progress. Problems are given at the end of each of the seventeen chapters. Appendices contain mathematical definitions and operations, a table of common units and answers to problems. An index and a few illustrations are included.

Comprehensive bibliography of cement and concrete, 1925-1947. F. O. Slate, Lafayette, Indiana, Purdue university, Engineering experiment station, 1952, 491 pp., $6.00.

Arranged under classified subject-headings, all of which are listed in the table of contents, and under those heads, alphabetically by author, this bibliography claims to cover the complete world literature in the fields of cement and concrete published from January first, nineteen hundred and twenty-five, to December

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Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

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thirty-first, nineteen hundred and forty-seven.

The field of technical publications in chemistry has been exhaustively covered, as have also the engineering technical publications. Reports of construction experiences and borderline publications have been included where they were considered to be of value.

Included also is a partial list of bibliographical sources of information and indices consulted.

An alphabetical index to authors, and spiral binding and loose leaf format make for considerable case of use.

Dialogues concerning two new sciences. Galileo Galilei. Henry Crew tr. introd. by Antonio Favaro. New York, Dover, Toronto, Macmillan, 1914. 300 pp., illus., Special new paper ed., $2.00.

To render the Physics of Galileo accessible to English-speaking students has been the purpose of this translation. The text of the National edition — essentially the Elzevir edition of 1638, has been strictly followed. All comments and annotations have been omitted save here and there a footnote intended to economize the reader's time. The translators have made this translation as literal as was consistant with clearness and modernity (1914). In cases where there was an important deviation from this rule, and in the case of many technical terms where there was no deviation from it, the original Italian or Latin phrase is given in italics enclosed in square brackets. Into this volume, Galileo seems to have gathered, during his last years, practically all that is of value either to the engineer or the physicist. This is one of a new series of paperbound scientific books published by Dover. It contains the original diagrams and drawings and is indexed.

Engineering Law. R. E. Laidlaw and C. R. Young: 4th ed. Toronto. University of Toronto press, 1951. 394 pp., $4.75.

This is the first revision of a recognized basic source of information for the engineer having to do with the legal aspect of his profession, since nineteen hundred and forty-six.

The chief improvements in this revision, are the addition of extracts from reports of typical cases to illustrate pertinent principles wherever possible. Legal technicalities and terms have given place to engineering practicalities. But at the same time the engineer is warned that where important matters of law are involved, a lawyer should be consulted.

Changes in the legal aspects of engineering since nineteen hundred and forty-six have been incorporated into the appropriate chapters, and the information on labour laws and Workmen's compensation have been completely rewritten.

There is important information in this volume for many of our members.

Engineering materials: their mechanical properties and applications. Joseph Marin. New York, Prentice-Hall, 1952. 491 pp., illus., $10.45 (Canada).

This text is concerned with the mechanical properties of engineering materials. Its objective is to provide sufficient information on the behavior of stressed materials to permit their intelligent selection and use.

It is divided into three parts. The first deals with the mechanical properties of materials, their definition, determination and utilization. The behavior of materials under various types of loading conditions is treated. The second deals with specific materials while the third presents a discussion of the more important testing machines and strain gauges. Questions (with answers) and a bibliography of books are presented at the end of each of the twelve chapters. An index is included and illustrations provided through diagrams and photographs.

Frost action in roads and airfields: a review of the literature, 1765-1951. A. W. Johnson. Washington, Highway research board, 1952. 287 pp., illus., $3.60. (Highway research board special report No. 1).

This review summarizes, in chronological order, the most important contributions to the literature of frost action on roads and airfields. For each article quoted or discussed, complete reference is given in a thirty-page bibliography. The intention of the reviewer has been to aid the reader in understanding the effects of soil freezing and thawing on foundations of pavement and structures. An attempt has been made to separate pertinent statements and arrange data and illustrations to make them readily available to the reader. In many instances the reviewer has quoted directly from the authors. The chronological order enables the reader to follow the development of knowledge and, in some instances to observe the changing views of writers with the passing of time. Apart from the aforementioned outstanding bibliography, an excellent index is included and so are numerous photographs, maps, diagrams and tables.

Fundamentals of electronics and control. M. G. Young and H. S. Bueche. New York, Harper, c1952. 525 pp., illus., $7.20.

This is a fundamental textbook written for students and graduates of all branches of engineering. Although its approach to electronic problems might be considered as basic, it is assumed that the reader has completed an elementary course in electrical engineering or in general physics. The text has been made sufficiently flexible to allow the instructor to occasionally disregard some material, without sacrifice of continuity. It is divided into the following ten chapters: electron theory, basic circuit components and control, principles of electron emission, high vacuum (hard) tubes, tubes utilizing gas (soft tubes), mercury pool tubes, amplifiers, oscillators, modulation and demodulation, rectifiers. At the end of each chapter, the reader will find a few pages of problems (with answers) and a list of references to magazine articles. An index and thirteen appendices giving charts, curves and symbols are also included. The illustrations consist of diagrams and photographs of equipment.

Manual of British water supply practice. A. T. Hobbs, ed. London, Institution of water engineers, c1950. 910 pp., illus., maps, 50/–.

In twenty-five chapters, the present work deals with twenty-five aspects of water practice. These are: historical development, fundamental considerations in waterworks planning; hydrology; hydrogeology; hydraulics; impounding reservoirs, ancillary works and gathering grounds; river works and intakes; aqueducts; wells, adits and boreholes; pumping plant and buildings; water treatment plant: design, maintenance and operation; service reservoirs and water towers; boosting; distribution, mains, etc., and water for fire purposes; service, waste and district heating; hygiene; chemical and physical examination of water; bacteriological examination of water; biological examination of water; filtration and sterilization; water softening; prevention of pollution; law relating to water supply; finance relating to water supply; organization and management. This manual is not a textbook. It should be regarded, rather, as an authoritative survey of sound waterworks practice providing the fundamental outline of each of the aforementioned subjects. References to more elaborate works are given at the end of each chapter. A detailed index and a list of pertinent British standards are included. Many drawings, diagrams, maps and other figures illustrate this volume.

Matter and motion. J. C. Maxwell. New York, Dover. 163 pp., illus., $1.75 in Canada.

In this reprint of Maxwell's original 1877 treatise on the principles of dynamics, the changes have been confined strictly to some typographical and a few verbal improvements. Only brief footnotes have been introduced, the original ones being distinguished by Arabic numeral references instead of asterisks and other marks. The index is short and recent. The treatment of the fundamental principles of dynamics has been enlarged on the author's own lines by the inclusion of the chapter "On the equations of motion of a connected system" from the second volume of "Electricity and magnetism". Two appendices have been also added by the editor. One of them treats of the principle of relativity of motion, while the other aims at development of the wider aspects of the principle of least action. The book contains a few diagrams. It is part of the new series of paperbound scientific works published by Dover, the regular clothbound edition being available in the United States at $2.50.

Methods of analysis of fuels and oils. J. R. Campbell. London, Constable, Toronto, Longmans, Green, c1951. 216 pp., illus., $6.00.

The object of this book has been to provide, within the compass of a single volume, a laboratory guide to the principal methods of examination of gaseous, liquid and solid fuels and lubricating oils. It has been designed primarily to meet the requirements of British students of applied chemistry, metallurgy and engineering taking a course in fuel technology. Standard methods of examination recommended by the British standards institution and the Institute of petroleum have been closely followed. In the section dealing with gas analysis, an attempt has been made to select from the large number of gas analysis units available, a few which are not only typical and well known, but which will lead the student from the essentially practical unit to the more precise type in easy stages. Brief resumés of the theoretical principles have been included in a number of instances. Diagrams, drawings, a short bibliography, an index and a few tables further the usefulness of this book.

The phase rule and its applications. Alexander Findlay. 9th ed. rev. and enl. by A. N. Campbell and N. O. Smith. New York, Dover, c1951. 494 pp., diags., $2.30. (Canada)

Professor Findlay's work, originally published in 1903, has been largely rewritten by the present authors. In the original edition, the exposition of the phase rule and its applications had been

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made entirely non-mathematical. While it had been sought to make the treatment sufficiently elementary to be understood by the student just commencing the study of chemical equilibria, an attempt had been made to advance his knowledge to the point where he could study with profit the larger works on the subject. "The phase rule" has, however, been rewritten in such a way that the present 1951 edition will serve the needs of graduate students and of those engaged in research in the subject. Extensive author and subject indices are included. Numerous diagrams provide visual explanations.

Production control. P. D. O'Donnell. New York, Prentice-Hall, 1952. 304 pp., $5.70. (Canada)

This is a basic text for the use of those desiring an elementary knowledge of production control. Highly technical and specialized applications have purposely been omitted. The author has proceeded from the assumption that there is no standard production control procedure. He shows that the correct procedure for each company is governed by the type of the company, its size, its products and the capabilities of its staff. In this book, twelve chapters cover the following subjects: production forecasting, product development, plant layout, materials handling, control of materials, routing, scheduling, dispatching, follow-up, quality control, statistical quality control, cost control. An index and a bibliography of books are included.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

ASTM book of standards. Including Tentatives. 1951 Supplement. Part 1: Ferrous Metals, 402 pp.; 2: Non-Ferrous Metals, 346 pp.; 3: Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, Soils, 265 pp., 4: Paint, Naval Stores, Wood Adhesives, Paper, Shipping Containers, 253 pp.; 5: Textiles, Soap, Fuels, Petroleum, Aromatic Hydrocarbons, Antifreezes, Water, 324 pp.; 6: Electrical Insulation, Plastics, Rubber, 233 pp. Philadelphia. American Society for Testing Materials, 1951. Illus., $3.50 each.

These supplementary sections contain the extensively revised standards, and the new and extensively revised tentatives in the respective fields, that have been accepted since the appearance of the 1950 supplement. By means of these supplements the results of the standardization activities of the ASTM are made available for the years between the triennial issues of the complete Book of Standards.

ASTM standards on copper and copper alloys. Philadelphia, American Society for Testing Materials, 1952. 504 pp., $4.75 (cloth $5.40).

The more than 100 standard or tentative methods of test and specifications in this compilation are broadly classified as follows: copper and copper-alloy products for electrical purposes; plate, sheet, strip, and rolled bar; rod, bar, and shapes; copper-alloy wire; pipe and tube; ingots and castings; arc-welding electrodes and brazing solder; methods of test for copper and copper alloys. There have also been added certain selected specifications for non-ferrous metals and alloys used in the manufacture of copper-alloy products.

Manual of ASTM standards on refractory materials. Philadelphia, American Society for Testing Materials, 1952. 294 pp., illus., $3.00. (cloth $3.65).

In addition to the latest approved forms of thirty-seven standard and tentative specifications the current edition of this manual includes other pertinent information of value in the testing and use of refractories. There are suggested procedures in petrographic techniques and for calculating heat losses through furnace walls, standard samples for chemical analysis, industrial surveys of service conditions of refractories, a proposed glossary, etc.

ASTM specifications for steel piping materials. Philadelphia, American Society for Testing Material, 1952. 372 pp., illus., $3.50.

This compilation contains all ASTM specifications for carbon-steel and alloy-steel pipe and tubing. It covers pipe to convey liquids, vapours, and gases at normal and elevated temperatures, still tubes for refinery service, and tubes for boilers, heat exchangers, condensers, and superheaters. Specifications are also included for castings, forgings, bolts, and nuts used in piping installations. A number of emergency alternate provisions in separate form are provided with the book or will be sent subsequently.

Brans' vade-mecum 1952. P. H. Brans, Ltd. Antwerp, Brans, 9th edition, 1952. 416 pp., paper. $5.00.

This comprehensive annual guide provides a general index of world-wide radio tube types, tables of tube characteristics, and tables of base connections. This edition contains only receiving and transmitting tubes, which are tabulated in numerical and alphabetical order. Army

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tube types and specialized tubes will be listed in a new edition. The introduction and the necessary directions or instructions are given in eight languages.

Chill-cast tin bronzes. D. Hanson and W. T. Pell-Walpole. London, Arnold, Toronto, Longmans, 1951. 368 pp., illus., $15.00.

This book is designed to provide a comprehensive metallurgy of bronze with special reference to ingots and castings made in metal molds. Following a historical survey and a general treatment of the constitution of bronzes come two chapters on the melting process and three chapters on the casting process. Both theoretical and practical details are discussed. Subsequent chapters cover segregation, the effect of minor constituents and solid impurities, heat treatment of cast bronze, and the metallurgical aspects of wrought bronzes. Properties and uses of cast bronzes are given, and extensive bibliographies are included.

Exhaust hoods, 2nd ed. J. M. Dalla Valle. New York, Industrial Press, 1952. 146 pp., illus., $4.20.

Comprehensive information is given on the flow of air around and into the openings, hoods, or slots in exhaust ventilating systems. Full instructions are given for the design of hoods for removing dust, fumes, and gases under various conditions such as in grinding, woodworking, electroplating, etc. Calculations are given for five actual designs.

Farm power. B.D. Moses and K. R. Frost. New York, Wiley 1952. 484 pp., illus., $6.90 in Canada.

Beginning with a discussion of the relation of farm power to agriculture, this textbook presents its technical information in two succeeding major sections. Part 2 deals with the internal-combustion engine: principles of the otto- and Diesel-cycle engines, parts, accessories, troubles, types, and operation. Part 3, covering the farm tractor, includes discussion of tractor types, field requirements, economics, selection, operation, testing, attachments, maintenance, and repairs.

Heating, ventilating, air conditioning guide, 1952. Volume 30. New York, American Society of Heating and Ventilating Engineers, 1952. 1496 pp., illus., $9.00 in Canada.

A standard reference book; its fifty chapters are devoted to such varied topics as the fundamentals of thermodynamics, the physiological bases of heating and air conditioning, the calculation of heating and cooling loads of enclosed spaces, and to descriptions of systems and apparatus such as steam-heating systems, panel heating, electric heating, refrigeration, and drying systems. The numerous changes in this new edition are listed in the preface. There is a large indexed section of condensed manufacturers' catalogs.

Industrial heat transfer. F. W. Hutchinson. New York, The Industrial Press, 1952. 326 pp., illus., $7.20 in Canada.

A combined text and reference book, providing a selective approach to problems of heat transfer analysis and to the rapid evaluation of coefficients and rates. In addition to the basic relationships for conduction, radiation, convection, and combined heat transfer for which both equations and graphs are given, there are individual graphs for forced convection of some 70 gases and liquids, alphabetically arranged. The graphs are scaled for accuracy comparable to the equations, and explanatory text material appears on the facing pages.

Industrial magnetic testing. N. F. Astbury. London, The Institute of Physics, 1952. 132 pp., illus., 25s. 0d.

An analysis of methods for testing and measuring the properties of magnetic materials used in industry, this text will be useful to manufacturers and users of these materials. Among topics dealt with are the magnetic circuit, instruments, permeability and hysteresis measurements, power loss measurements, alternating current bridge and potentiometer measurements, permanent magnet testing, and properties of materials.

Strain gauges: Theory and Application. J. J. Koch and others. Eindhoven Philips' Gloeilampenfabrieken, Houston, Elsevier, 1952. 95 pp., illus., $3.30.

Prepared by the Netherlands Industrial Organization for Applied Scientific Research and the Philips Industries, this study is for the use of both technicians and students. It deals with the construction and use of strain gauges and measuring instruments for testing problems encountered in practical engineering and in the laboratory, and with the interpretation of values obtained. A chapter on stresses and the theories of failure is included.

A treatise on milling and milling machines. Cincinnati, Cincinnati Milling Machine Company, third edition, 1951. 910 pp., illus., $9.60 in Canada.

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machines and their accessories as well as the cutting tools used in these operations. Typical examples of actual installations are given to demonstrate proper work handling. The chapters on materials for and types of milling cutters are based on company research. Some forty pages are devoted to the sharpening and care of cutters. Special chapters deal with the power required in milling and with estimating production milling.

STANDARDS

British standards, British Standards Institution, 24/28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian Standards Association, National Research Building, Ottawa, Canada.

B.S. 919:1952 — Screw gauge limits and tolerances. 5/–.

A new approach to gauging practice suggests having a general "Go" gauge with its tolerance zone inside the work limits in place of the former "workshop" and "inspection" gauges. Tolerances are specified for screw gauges and setting plugs for screw threads in the regular series such as B.S. Whitworth, B.S. Fine, B.S. Pipe (Parallel threads), UNC, UNF, Metric (S.I.) and B.A. etc.; they may also be applied to gauges for any screw threads of Whitworth unified or Metric (S.I.) form.

B.S. 1837: 1952 — Methods for the sampling of ferrous metals and metallurgical materials and metallurgical materials for analysis. Part 1: Iron and Steel. 2/6.

Of the four sections into which this standard is divided, section one sets out the general requirements, section two deals with liquid iron and liquid steel, section three covers the sampling of pig, cast and wrought iron, and section four includes information on the sampling of steel in the form of ingots, castings, blooms, billets, slabs, heavy sections, plates, light sections, bars, rods, wire, sheet, strip and tubes.

B.S. 1855: 1952 — Dimensions of bifurcated, tubular, and semi-tubular rivets for general purposes. 4/–.

This new standard specifies dimensions of a) oval head, flat countersunk bevel head bifurcated rivets; b) oval head, flat countersunk head, and flat countersunk bevel head solid drilled tubular rivets; c) oval and flat countersunk head semi-tubular rivets.

B.S. 1856: 1952 — General requirements for the metal-arc welding of mild steel. 5/–.

Included in this standard are parts dealing with materials, details of butt and fillet welds, information required by the welding organization, welding equipment and electrodes, welding procedure, workmanship, welding operators supervision and inspection and heat treatment in testing. A first appendix gives useful information on butt welds including a full range of recommended preparations. A second appendix gives information on fillet welds.

B.S. G. 100: 1952 — General requirements for electrical equipment and indicating instruments for aircraft. 6/–.

The present standard contains sections on requirements relating to operating conditions, materials and processes, particular design requirements and tests. Although the general requirements stipulated in the specifications are for use in conjunction with specifications in the British Standards "G" series for aircraft materials and components, they may also be applicable to other aircraft electrical equipment or indicating instruments, where appropriate.

B.S. G. 140: 1952 — Hand-operated A.C. circuit-breakers for aircraft. 1/6.

This specification covers the requirements for hand-operated circuit breakers for use in nominal 200 volt, three phase, 400 cycle A.C. systems in aircraft.

TECHNICAL BULLETINS RECEIVED

American society for testing materials. Special technical publications:

No. 125 — Bibliography of photoelectric spectrophotometric methods of analysis for inorganic ions, by J. W. Stillman and E. C. Dunlop.

No. 127 — Changes in characteristics of Portland cement as exhibited by laboratory tests over the period 1904 to 1950, by H. F. Gonnerman and William Lerch.

California University. Department of geological sciences. Bulletin:

V. 28, No. 12 — A miocene phyllostomatid bat from Colombia, South America, by D. E. Savage. V. 28, No. 13 — The Sobrante sandstone, by G. C. Lutz.

Canada. National research council. Canadian government specifications board. Provisional specifications:

No. 1-GP-47P — Paint: obliterating.

. . Specifications:

No. 5-GP-18 — Counters; fibre, men's. No. 5-GP-19 — Counters; fibre, women's. No. 5-GP-21 — Leather; lining, vegetable tanned East India goatskins. No. 37-GP-4 — Cement; lap, asphalt roofing. No. 37-GP-7 — Roof coating; asphalt cutback unfilled. No. 37-GP-8 — Roof coating; asphalt cutback filled. No. 42-GP-4 — Boilers, double; aluminum with covers,

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While 30,000 p.s.i. tensile strength is a reasonable average for ordinary cast irons, Ductalloy is available in tensile strengths ranging from 65,000 p.s.i. upward. With this high strength, due to the favourable graphite form, the toughness of Ductalloy is many times that of cast iron.

Ductalloy is much more easily machined than cast gray iron of similar hardness and its cut surfaces are smoother.

If your interests lie in obtaining stronger, tougher and more finely finished castings, send the coupon.

Ductalloy is a Registered Trade Mark of Otaco Limited

Typical example of air compressor and air tool castings supplied in fully annealed 60 - 45 - 15 Ductalloy. Machinability and resistance to shock are characteristics of Ductalloy in these applications.

The International Nickel Company of Canada, Limited
25 King Street W., Toronto, Ontario.

Dear Sirs: Please send printed material regarding ductile iron and its applications.

Name..... Title .....

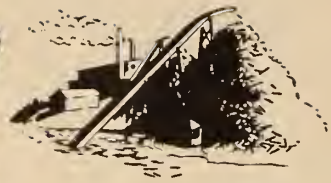
Company .....

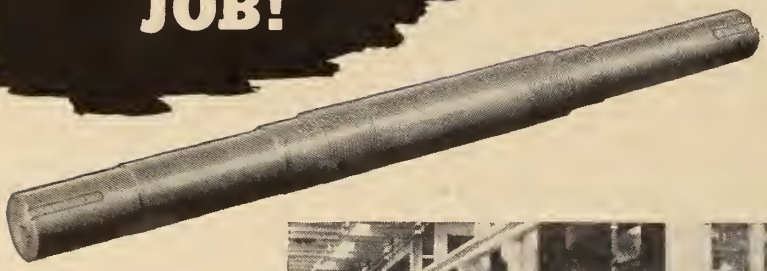
Address..... Q-8

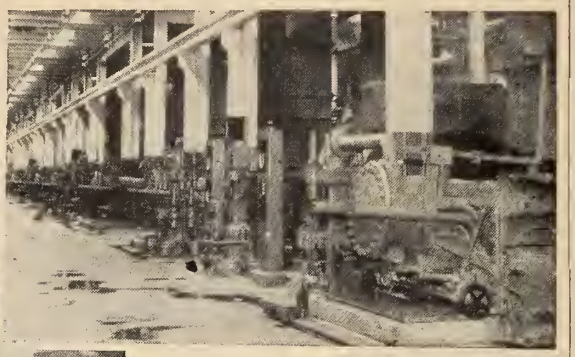
EMBLEM OF INCO SERVICE
TRADE MARK

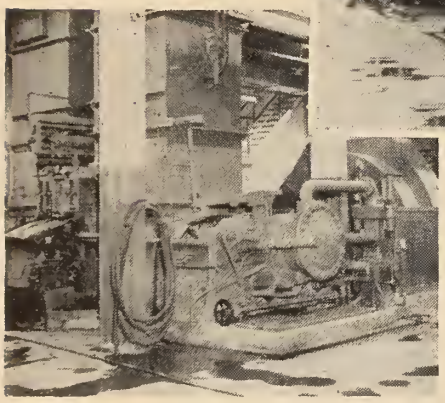
THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED
25 KING STREET W., TORONTO

"BRAWN" FOR A RUGGED JOB!









Pulpwood grinder installations at the Abitibi Power & Paper Mills at Iroquois Falls, supplied by Waterous Limited, and equipped with Canforge grinder shafts.

Constant vibration . . . the roaring, punishing action of pulp logs surging through the grinding mill . . . meets rugged opposition from the Canforge steel grinder shafts in such paper mill installations as this. It's another instance of quality forgings under severe test. Here at Canada Foundries & Forgings Limited is the modern equipment and facilities to supply the exacting demands of Canadian industry . . . the specific types of forgings for a myriad of needs.

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Light and Heavy Forgings for Aircraft, Automotive, Farm Implement, Hydro-Electric, Marine, Mining, Pulp and Paper and Transportation Industries. Your enquiry is invited.

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MONTREAL-BROCKVILLE-TORONTO-WINNIPEG-VANCOUVER

institutional. No. 42-GP-6 — Dippers: aluminum institutional.

Canada. National Research Council. National research council review: 1951.

Canada. National Research Council. Radio and Engineering Division. Progress reports:
Progress report for October-December, 1951.

Danish national institute of building research. Annual reports:
No. 4 — Fiscal year 1950-1951.

Great Britain. Department of scientific and industrial research. Reports of the boards and of working parties:
Report of the chemistry research board, with the report of the director of the chemical research laboratory for the year 1950. Report of the fire research board with the report of the director of fire research for the year 1950. Report of the forest products research board with the report of the director of forest products for the year 1950. Report of the mechanical engineering research board with the report of the director of mechanical engineering research for the period May, 1947 to December, 1950. Report of the director of radio research for the year 1950. Report of the water pollution research board with the report of the director of water pollution research for the year 1950. Report of the ammonium nitrate working party.

. . . Reports:
Report for the year 1950-1951. United States army. Corps of engineers. Office, chief of engineers.

Technical memoranda:
No. 6-330 — Investigation of the suitability of Prepakt concrete for mass and reinforced concrete structures, by Waterways experiment station.

United States. Department of commerce. National bureau of standards. Building materials and structures reports:
No. 127 — Effect of aging on the soundness of regularly hydrated dolomitic lime putties.

United States. Highway research board. Bulletin:
No. 47 — Salvaging old pavements by resurfacing.

United States. Beach Erosion Board. The Bulletin: Vol. 6, No. 2, April 1, 1952.

United States. Beach Erosion Board Technical memoranda:
No. 12—Durability of steel sheet piling in shore structures.

United States. Highway Research Board. Bulletins:
No. 1946 — Engineering soil survey mapping.

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No. 128 — Atmospheric exposure tests of nailed sheet-metal building materials.

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Advanced antenna theory. S. A. Schelkunoff. New York, Wiley, 1952. 216 pp., illus., $7.80. (Canada)

Analytical mechanics for engineers. 4th ed. F. B. Seely and N. E. Ensign. New York, Wiley, c1952. 443 pp., illus., $6.60. (Canada)

From Coal Pile to Kilowatts

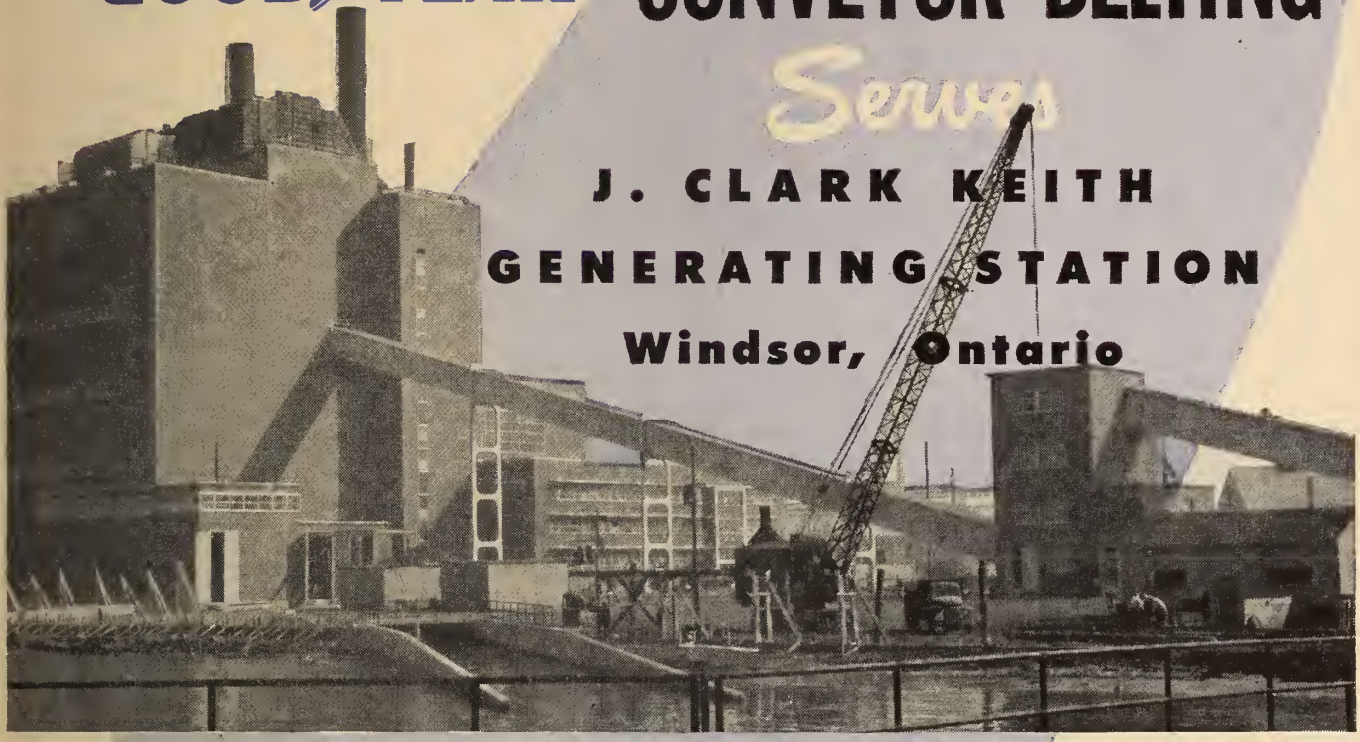
GOODYEAR CONVEYOR BELTING

Serves

J. CLARK KEITH

GENERATING STATION

Windsor, Ontario

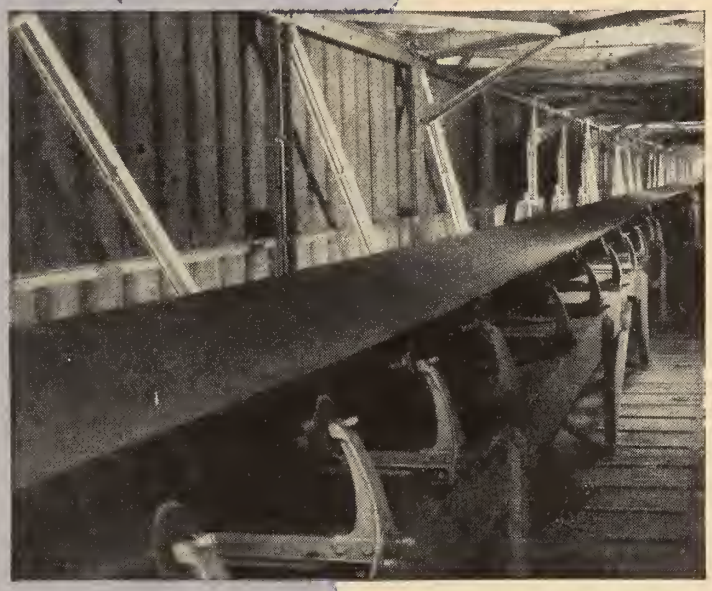


Since November, 1951, when its first 61,000 Kilowatt unit began operating, coal for the giant furnaces of the new Windsor plant has been conveyed on Goodyear Conveyor Belts.

By 1953, Ontario Hydro's 200′ by 175′ steam electric generating station, shown above, will have a capacity of 264,000 Kilowatts (354,000 horsepower). The crusher house at right center, receives the coal from the stockpile before being conveyed to the bunkers in the station.

This important conveyor system is equipped 100% with Goodyear Conveyor Belts, Style "B". This system starts coal from dockside at 1250 tons an hour and deposits crushed coal in the bunkers in the power house at 400 tons an hour. Every ton of coal used travels on a Goodyear Belt.

If you have a conveyor problem, large or small, consult your nearest Goodyear Branch at Saint John, N.B., Quebec City, Montreal, Toronto, London, Winnipeg, Regina, Saskatoon, Calgary, Edmonton and Vancouver.



Note the massive, rugged appearance of this section of the 36"x 938′ Type "B" Conveyor that transports 400 tons per hour from Crusher House to Bunkers.

GOODYEAR

MG 5230

INDUSTRIAL RUBBER PRODUCTS ENGINEERED FOR THE JOB

Antennas, theory and practice. S. A. Schelkunoff and H. T. Friis. New York, Wiley, 1952. 639 pp., illus., $12.00 (Canada).

The artificial satellite: the proceedings of the second international congress on astronautics, London 1951. L. J. Carter ed. London, British interplanetary society, 1952. 73 pp., illus., 75 cents.

Civil engineering reference book. E. H. Probst and J. Comrie ed. Toronto, Butterworth, 1951. 1703 pp., illus., $22.00.

The co-operative movement and some of its problems. P. H. Casselman. New York, Philosophical library, c1952 178 pp., $3.60.

Elementary heat power, 2nd ed. H. L. Solberg and others. New York, Wiley, c1952. 624 pp., illus., $7.80. (Canada)

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Finishing handbook and directory 1952. W. J. Roberts and A. G. Bennett ed. London, Sawell, 1952. 600 pp., illus., 15/–.

Gears; spur, helical, bevel and worm. P. S. Houghton. London, Technical press, 1952. 408 pp., illus., 50/–.

Geology of Quebec. Volume 1, Bibliography and index, supplement A 1937-1949. Quebec Bureau of Mines. Quebec, the Bureau, 1951. 91 pp., $0.50.

ON THE THERMAL CONDUCTIVITY OF $1

This Dollar was one of several spent on a Green's PREMIER DIAMOND ECONOMISER and induced-draught equipment, working with three new water-tube boilers of 300 nominal H.P.

It bought enough high-efficiency heating surface (erected and working) to reclaim 240 B.Th.U's of waste-heat from the chimney gases per hour.

By transferring this heat to the boiler feedwater it saves coal worth 40 cents a year. In 2½ years the outlay is returned in full and thereafter the Economiser earns for its owner 40% per annum interest for say 30 years. A very average case.

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MAKERS OF ECONOMISERS & AIRHEATERS

Section of Premier Diamond Economiser Tube

GE 68

Heat. R. C. Brown. Toronto, Longmans, 1952. 270 pp., illus., $2.70.

Horner's dictionary of mechanical engineering terms. Part 1: Modern terms; part 2: General and traditional terms. Originally compiled by J. G. Horner, 7th ed. revised and enlarged by Staton Abbey. London, Technical Press, 1952. 121; 417 pp., 22/6.

Human relations in supervision: leadership in management. W. E. Parker and R. W. Kleemeier. Toronto, McGraw-Hill, 1951. 472 pp., illus., $6.25.

Hutchinson's pocket technical encyclopedia. L. E. C. Hughes and J. P. Bremner comp. London, Hutchinson's, Toronto, Ryerson, 1952. 182 pp., $1.75.

I E S lighting handbook: the standard lighting guide, 2d ed. Illuminating Engineering Society. New York, the Society, 1952. Various paging, illus., $9.60. (Canada)

Introduction to electrical engineering, 2nd ed. R. P. Ward. New York, Prentice, 1952. 412 pp., illus., $6.75.

Introduction to electronic circuits. R. Feinberg. Toronto, Longmans, 1952. 163 pp., illus., $3.60.

Kempe's engineer's year-book for 1952, 57th ed., 2 Volumes. B. W. Pendred reviser. London, Morgan Brothers, 1952. V. 1, 1467 pp.; v. 2 1440 pp., illus., 71/6.

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Principles of lighting. W. R. Stevens. London, Constable, Toronto, Longmans, c1951. 482 pp., illus., $7.00.

Proceedings of the National electronics conference, vol. 7, 1951. Chicago, The Conference, 1952. 607 pp., illus., $6.00. (Canada)

Productivity and probability. T. F. O'Connor. Manchester, Emmott, c1952. 193 pp., illus., 5/–. (Mechanical world monograph No. 65).

A reference handbook for construction engineers, architects, builders, superintendents of construction and building construction foremen. H. G. Richey. New Orleans, Richey, c1951. Various paging, illus., $12.00. (Canada)

S A E manual on shot peening. Society of Automotive Engineers. New York, the Society, 1952. 45 pp., illus., $3.00.

Selling to industry. Bernard Lester. New York, Industrial Press, c1952. 255 pp., $4.20. (Canada)

A statue to Mr. Trattles, and other scientific topics. C. L. Botz. Toronto, Butterworth, 1952. 168 pp., illus., $2.00.

Steam power plants. A. H. Zerban and E. P. Nye. Scranton, Pa., International textbook, Scranton, Laurel, 1952. 524 pp., illus., $9.00. (Canada)

The supply of water, 2nd rev. ed. T. H. P. Veal. London, Chapman, Toronto, British book service, 1950. 276 pp., illus., $5.00.

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La vibration du béton. G. Barcelo. Paris, Eyrolles, 1952. 219 pp., illus., 1300 fr.

Who's Who in Commerce and Industry, 7th international edition, including the catalog of selected principal businesses, which by Marquis locator indexing provides reference from listed companies to career sketches of their ranking executives. A. N. Marquis Co. Chicago, the Company, 1951. 1355 pp., $12.85. (Canada)

PAMPHLETS RECEIVED

Aluminum bus conductors: channel, flat, tubular. Montreal, Aluminum Company of Canada, c1952.

A S M E boiler construction code, addenda to: Low-pressure heating boiler code (2 parts); Material specifications; Power boiler code (2 parts); Unfired pressure vessel code (3 parts); Welding qualifications code. American Society of Mechanical Engineers. New York, the Society, 1952.

Concrete cracking. L. B. Mercer. Melbourne, Ready mixed concrete. (Commonwealth Engineer, Sept., Oct., Nov., 1951 reprint).

The effect of fabrication processes on steels used in pressure vessels: Notch toughness of steel plate which had been prepared by machining, flame cutting or shearing. S. S. Tor and others. Bethlehem, Pa., Lehigh University, Fritz Engineering Laboratory. (Welding Journal research supplement, Sept., 1951).

Ferroxdure, a class of new permanent magnet materials. J. J. Went and others. Eindhoven, N. V. Philips' Gloeilampenfabrieken. (Philips technical review, v. 13, n. 7, Jan., 1952).

The fire service drill book. Great Britain, Home Office, Fire service department. London, H.M.S.O., Ottawa, United Kingdom Information Office, c1949.

Fuel saving charts. Walter Goldstern. London, John D. Troup Ltd., (24 articles reprinted from The Steam Engineer).

Fundamentals of instrumentation for the industries. Philadelphia, Minneapolis-Honeywell Regulator Co., c1952.

Jubilee book of the National Physical Laboratory. John Langdon-Davies. London, H.M.S.O., Ottawa, United Kingdom Information Office, 1951.

Plastic design and the deformation of structures: study of the plastic behavior of continuous beams together with a discussion of the deformation of structures in the plastic range and a criterion for selection of the full load in the plastic design method. C. H. Yang and others. Bethlehem, Pa., Lehigh University, Fritz Engineering Laboratory. (Welding Journal research supplement, July 1951).

Program aids from business and industry. Toronto, Canadian Association for Adult Education, 1952.

The principles of extraction and refining of metals: lectures delivered at the Institution's refresher course 1950. London, Institution of Metallurgists, 1951.

The story of the British gas turbine: a Festival survey. Ottawa, United Kingdom Information Office.

Testing hot metal ladles. K. E. Knudsen and others. Bethlehem, Pa., Lehigh University, Fritz Engineering Laboratory.

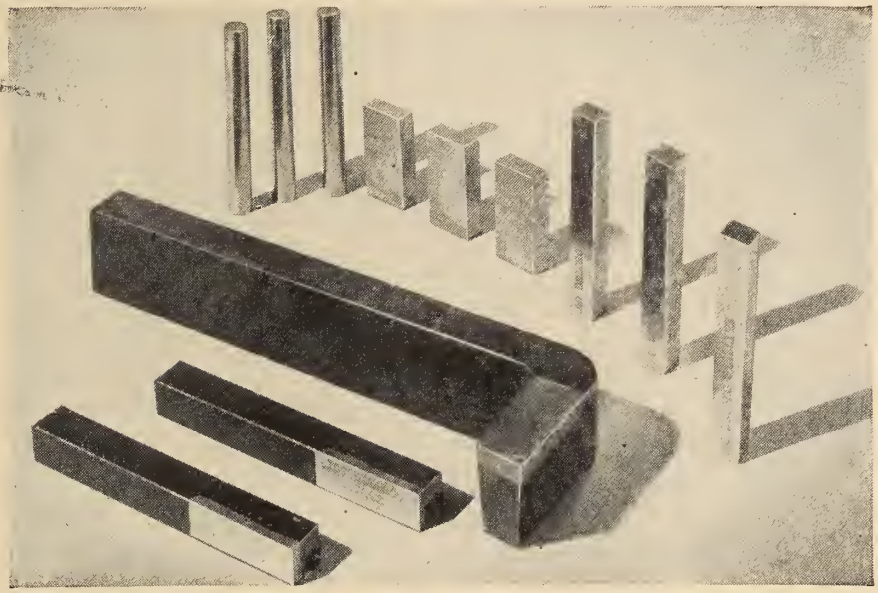
BRANCH NEWS

(Continued from page 876)

be used within their capacity to receive the waste discharge of industrial and domestic establishments. Already, in many localities in the U.S.A., the point has been reached where bodies of water are no longer the infinite diluents we commonly suppose them to be. The fact that there are 20,000 sources of pollution in the United States, about equally divided between domestic and industrial sewage, makes it impossible to apply a single set of general rules. Hence, each case must be appraised with respect to its own particular character before hasty action is attempted towards abatement. With the aid of slides, Mr. Jenkins illustrated some of the problems associated with the handling of sewage from his company's chemical plant situated at South Charleston. He recommended that the setting of standards be avoided insofar as possible.

The speaker was thanked by Mr. E. R. McMullen of Trois-Rivieres.

More than 55 members were in attendance at the dinner meeting.



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heavier feeds...deeper cuts...

DOUBLE OUTPUT

Because they do not burn even when Red Hot, *Deloro Stellite 100 tools* permit heavier feeds—deeper cuts. This reduces machining time, in many instances doubling and tripling production. Write for your price list on grade 100 tips and tipped tools today.

"DELORO STELLITE"

non-ferrous alloy of Cobalt, Chromium and Tungsten

Outwears steel up to 25 times

DELORO SMELTING AND REFINING CO. LTD. *Deloro, Ont.*

- HARDFACING RODS AND ELECTRODES
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- GRADE "100" CUTTING TOOLS FOR HEAVY FEEDS
- CUSTOM STELLITING BY EXPERTS
- GAUGES, CENTRES, MACHINE COMPONENTS
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Roof Structures – P.D.Q.

for store and shop buildings

You cover your buildings amazingly fast when you use engineered timber trusses of Timber Structures, Ltd. Trusses arrive on the jobsite completely fabricated, ready for easy, fast assembly and erection. No cutting, boring, fitting or lost time. Walls and columns may be masonry, tile, steel, timber or whatever combination produces the desired overall structure at economical first cost and with minimum upkeep.

Timber Structures trusses include both bowstring and flat types with chords of glued laminated timbers, composed of kiln-dried material bonded together with glues as permanent and strong as the wood itself. Free from all seasoning action, they "stay put" without maintenance. Also, they qualify as heavy timber or mill-type construction with highly effective resistance to destruction by fire, and resulting favorable insurance rates.

A new booklet, "Industrial Buildings", contains detailed information about these trusses. Get one at your nearest Timber Structures office; or complete and mail the coupon to us, and your copy will be sent you promptly.

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Enjoy benefits of smaller Cleveland worm gear units

WHEN you want a quiet, powerful, dependable drive for a small machine, choose a Cleveland Worm Gear Speed Reducer.

As built by Cleveland, the worm gear reducer is a drive of many advantages:

1. It is compact and inherently quiet, transmitting power with smooth, uninterrupted torque flow.
2. Its right-angled design saves valuable space.
3. It has a minimum of moving parts.
4. Shock load resistance and other factors of safety are high.
5. Rate of wear of case hardened steel worm on nickel-bronze gear is very low, insuring long life.

Illustrated above are the 10 AT (left) and 00 D (at right) speed reducers.

Write for Bulletin 114F which illustrates and gives engineering data on smaller size Clevelands—many now available for immediate delivery. Peacock Brothers Limited, 224 St. Patrick St., Montreal 32, Que. Also Calgary, Noranda, Sudbury, Sydney, Toronto, Vancouver and Winnipeg.

Representatives in Canada of The Cleveland Worm & Gear Co., and The Farval Corporation.

CLEVELAND
Worm Gear
Speed Reducers

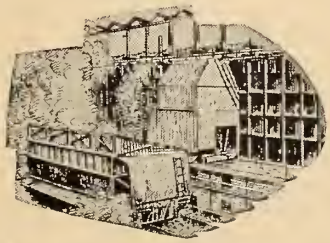
"ELECTRODS" ADD LENGTH AND STRENGTH TO NEW COKE OVEN PILING!

Lap-welding two forty-foot sections of steel piling and driving them to their full length into the ground is as severe a test of a welded joint as has ever been devised. But 960 of these piles were successfully driven to form the foundation of Stelco's new battery of 83 modern coke ovens. To increase the strength of the joint and the length of the weld, one pile was placed one foot inside the other and lap-welded as shown in the illustration. In driving the piles, 60 blows a minute were applied, each transmitting 1,500 foot pounds of energy.

Hammer blows—six per foot during the first seventy-seven feet . . . twenty-five per inch on the last three feet.

Approximately one thousand blows of the steam hammer were applied after the joint was welded.

The 704D Stelco "Electrod" used for lap-welding piles is one of an extensive range of Stelco Mild Steel "Electrods". It is especially adapted to fast, downhand welding and makes a strong, ductile joint that is highly resistant to impact and vibration. Other specialized "Electrods" are available to meet a full range of steel fabrication requirements.



THE Steel Company of Canada, LIMITED

EXECUTIVE OFFICES
HAMILTON — MONTREAL

SALES OFFICES: HALIFAX, SAINT JOHN; MONTREAL, OTTAWA, TORONTO, HAMILTON, LONDON, WINDSOR, WINNIPEG, VANCOUVER
J. C. PRATT & CO. LIMITED, ST. JOHN'S, NEWFOUNDLAND

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information received by

The Editor

Appointments and Transfers

J. A. Campanaro.—J. A. Campanaro has been named general manager, commercial development, Canadian Westinghouse Company Ltd. Mr. Campanaro will be in charge of the development of new business in civilian fields not previously participated in by the Company and he will continue to coordinate the Company's defence production work.

•

J. A. Campanaro

Atlas Steel Appointments. — Richard M. Davis has been appointed manager — personnel and public relations of Atlas Steels Ltd.

E. V. Murray, former manager — personnel and public relations, has been transferred to the purchasing division where he will be assigned to special managerial duties.

Mr. Davis is a member of the board of directors of the Company and has been in the sales and production divisions for a number of years.

•

Brown-Boveri Agent. — Brown-Boveri (Canada) Ltd. has announced the appointment of General Equipment Ltd., 702 Robie Street, Halifax, N.S., as agents for the Maritime Provinces and Newfoundland. The agents will handle the line of electrical and thermal power equipment, including transformers, air blast circuit breakers and switchboards which are now being manufactured at the Brown-Boveri plant at St. Johns, Quebec.

Brown-Boveri (Canada) Ltd. is a subsidiary of the internationally known Swiss engineering firm whose organization includes eight large plants in Europe with a total staff of forty thousand people. This firm has been supplying a wide range of products to Canadian industry since the turn of the century.

•

Trane Appointments.—Grant E. Cole, executive vice-president and general manager, Trane Company of Canada Limited has announced the following appointments in the head office organization.

K. E. O'Neill, who has had more than 14 years experience with Trane in air handling and air conditioning departments, has been appointed assistant sales manager.

J. H. (Pete) Bevan has been appointed to the position of manager of fan and coil division of the head office sales organization.

H. R. Grittani has been named manager of sales for climate changers, torridors and fluid coolers.

Brian E. Judges has been named assistant to the chief application engineer.

P. M. McHardy is now manager of the unit ventilator and Force-Flo heater divisions of the head office sales organization.

•

Marketing Radioisotopes.—The Right Honourable C. D. Howe, minister of defence production, announced on July 25th that the marketing of radioisotopes produced at Chalk River, which has been handled in the past two years by Eldorado Mining and Refining Limited, will be handled by Atomic Energy of Canada Limited as from August 1st, 1952.

•

O. A. Matthews.—O. A. Matthews has been appointed financial adviser in the department of Defence Production. He replaces L. D. Hudon who was appointed associate financial adviser when the department was established on April 1st, 1951. Mr. Hudon is returning to Sorel where he is general manager of Marine Industries Ltd.

•

B. L. Denker.—B. L. Denker has been appointed vice-president, process plants division, Foster Wheeler Limited. Mr. Denker has had extensive experience in the petroleum and chemical engineering and design and plant construction fields in the United States, Canada and abroad. He was associated with major installations by Imperial Oil Company at Sarnia and Edmonton; McColl-

K. E. O'Neill

J. H. (Pete) Bevan

H. R. Grittani

Brian E. Judges

P. M. McHardy

Frontenac, Edmonton; Dow Chemical Company at Sarnia; Royal Dutch Shell, in the Dutch West Indies; American Oil Company at Abadan and in Britain.

●

R. A. Westervelt.—R. A. Westervelt has been appointed vice-president, central district sales, of Foster Wheeler Limited.

He has been Toronto district manager of the Company since 1932.

●

Standard Paving. — Standard Paving and Materials Limited, Toronto, has made the following appointments: E. Birdsall, vice-president — paving and construction; J. T. Mogan, vice-president — materials, production and sales; J. H. Reid, vice-president — finance.

●

Shawinigan Changes.—The Shawinigan Water and Power Company has announced the following appointments. N. P. Woods, formerly vice-president and treasurer of the Company, has been appointed vice-president — finance and treasurer. Leo E. Boissonnault has been appointed assistant to the vice-president — finance, and Russell R. Merifield has been apointed assistant secretary.

●

Wild-Barfield in Canada. — Wild-Barfield Electric Furnaces Ltd. of Watford Herts, England, has opened a Canadian office. The new organization will be known as Wild-Barfield Electric Furnaces Ltd. The address is 7 Grenville Street, Toronto. J. E. Simpson has been placed in charge of the Canadian affiliate.

●

J. H. Berry.—J. H. Berry has been appointed general manager of Canadian Arsenals Limited. He succeeds E. Flexman.

●

K. J. Leeming.—K. J. Leeming has been appointed to the staff of The English Electric Company of Canada Ltd. Mr. Leeming has been intimately connected with the development of the prototype high pressure, high temperature steam turbo-alternator and will advise customers on plant and layout for any type of thermal generating station.

●

E. William Jewell.—E. William Jewell, chief of research and development, National Sewer Pipe Co. Ltd., Toronto, has been elected president of the National Clay Pipe Research Association. The organization is sponsored by clay pipe manufacturers in the United States and Canada, representing 70 per cent of the total production. The Research was established in 1944 for the purpose of extending the use of clay pipe to other fields and to advance new methods of manufacture and product application.

●

Johns-Manville Changes. — Canadian Johns-Manville Company Limited announce the following appointments. Frank A. Bromley, vice-president of the Company, has been named merchandise manager for building materials. Laurence M. Adamson is now merchandise manager for industrial products and has been appointed a vice-president of the Company.

●

L. P. Leduc.—L. P. Leduc has been named secretary of the Aluminum Company of Canada Ltd.

●

University of Toronto.—President Sidney Smith of the University of Toronto has announced two new appointments on the professorial staff of the department of chemical engineering.

Dr. P. H. Calderbank obtained his Ph.D. degree from University College, London, England, and has had considerable industrial experience in the field of heavy chemicals and polymers in addition to holding for the past six years the position of lecturer in the Ramsay Laboratory of Chemical Engineering at University College, London.

Dr. A. I. Johnson graduated from the Department of Chemical Engineering, University of Toronto, 1946, and obtained his masters degree from Brooklyn Polytechnic Institute in 1948, as well as his Ph.D. degree from Toronto in 1950. For the past two years he has been assistant professor of chemical engineering at Johns Hopkins University, Baltimore, Maryland. Dr. Johnson was the holder of many scholarships as an undergraduate and graduate student, including the Wallberg Research Fellowship and has specialized in his graduate work in the field of unit operations.

●

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  - ☐ *Industrial Flooring (wood blocks)*
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  - ☐ *Fence Posts*
- ☐ *Track Ties*
  - ☐ *Bridges*
- ☐ *Culverts*
  - ☐ *Marine Structures*
- ☐ *Pipe Lines*
  - ☐ *Power Line Poles*
- ☐ *Cross Arms*
  - ☐ *Mine Timbers*

Estimates and full information on request.

WOOD PRESERVING PLANTS IN:

TRURO, N.S.
NEWCASTLE, N.B.
DELSON, P.Q.
TRENTON, Ont.
SUDBURY, Ont.
SIOUX LOOKOUT, Ont.
NORTH TRANSCONA, Man.
PRINCE ALBERT, Sask.
CALGARY, Alta.
EDMONTON, Alta.
VANCOUVER, B.C.
NEW WESTMINSTER, B.C.

CANADA CREOSOTING COMPANY LIMITED
A Division of:
DOMINION TAR & CHEMICAL COMPANY LIMITED
SUN LIFE BUILDING, MONTREAL

CR2E-3

New Equipment and Developments

Canadian Capital Expenditures.—According to information released by the Department of Trade and Commerce, the total capital expenditures in 1952 on new construction and machinery and equipment are now estimated at $5,181 million. This is four per cent above the estimate made at the beginning of the year and 13 per cent ahead of the 1951 total. After allowance is made for the higher average cost of capital goods in 1952, the physical volume of investment this year may be up by about eight per cent over that in 1951. Estimated outlays for new construction are now $2,941 million, an increase of one per cent over the first estimate for the year and nine per cent above that for 1951. Machinery and equipment expenditures, now estimated at $2,240 million, are six per cent above the previous estimate for 1952 and 18 per cent higher than in 1951.

•

Building Trades Training.—The following statement was released by the Canadian Construction Association recently: "Current training and immigration programs of construction workers are not even sufficient to look after normal replacements let alone Canada's future needs". The statement was made by P. G. Wilmut, president of the Association when addressing members of the Kingston Builders' Exchange.

Mr. Wilmut continued "Valuable progress has been made in furthering our apprenticeship schemes but intensified efforts are most essential". He continued "The real danger is not that the trades will become overcrowded but that trades will die out due to the shortage of skilled tradesmen unless concerted efforts are made to increase their numbers. The latter trend has already affected several trades and has led to substitute materials and techniques."

•

Magnesium Production. — Production of magnesium at the Arvida Works of the Aluminum Company of Canada, Ltd. (Alcan) will be increased by four times according to an announcement issued by the Company on July second. This expansion will require an investment of approximately $2,000,000.

In 1943 Alcan put into operation a small pilot plant at Arvida and in 1945 capacity was increased to about 1,000 tons per year. Recent signing of an agreement with the U.K. Ministry of Materials, whereby the U.K. will have first call on 2,640 metric tons per year for a period of 20 years, necessitates further expansion to bring capacity up to 4,000 metric tons per year. Under the terms of a sales agreement Alcan will supply the U.K. with 3,000 metric tons of magnesium during the period of 1952-53. Part of the production not taken by the U.K. will be used by Alcan in the production of aluminum-magnesium alloys and the balance will be sold to the others.

The new plant will be operating at full capacity by April 1, 1953, and the increased production will materially increase the available supplies of magnesium, a strategic metal in the defence program of the United Nations.

•

Imperial Oil at Regina.—Contract for the major portion of a $7 million modernization program at Imperial Oil's Regina refinery has been let to the Fluor Corporation. Most of the construction workers will be recruited in the Regina area.

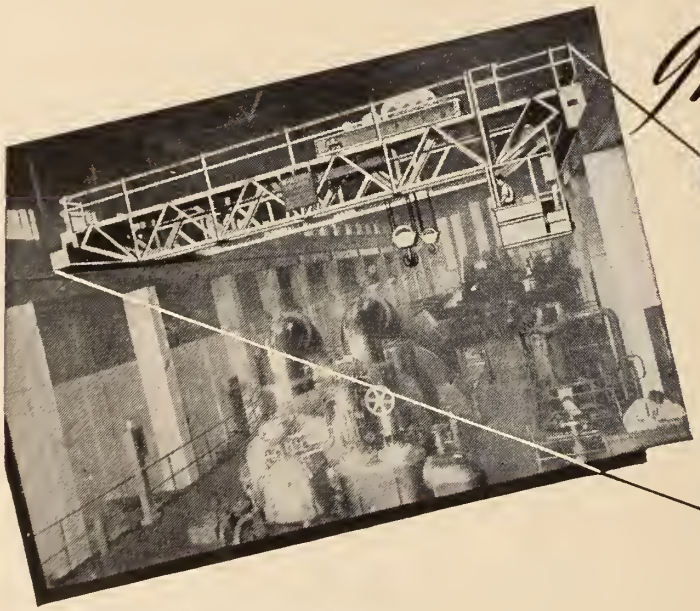
Plant construction is expected to begin late this year and be completed by the spring of 1954. Clearing and preparation of the site has started. The contract included the building of a 7,500 barrel-a-day fluid catalytic cracking unit, a vacuum distillation unit with a 9,000 barrel daily capacity, and a light ends plant for the recovery of gases. The expansion program will raise the refinery's capacity from 20,000 to 22,500 barrels a day.

•

Plastic Floor Resurfacer. — A new grease and oil resistant plastic floor resurfacer which, it is claimed, can be laid over an old existing floor, whether wood, concrete or metal has just been announced by the Dasco Chemical Company, 1602 Thames St., Baltimore, Md. The product is known as Dastex X. For further information write directly to the Company.

•

G.E. Oscillograph.—Four new accessories for the G.E. Portable oscillograph.

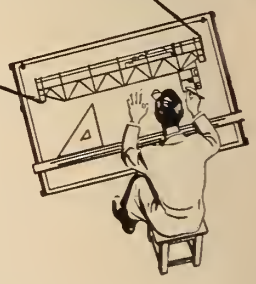


Individuality

from project ·· to performance

The safe and efficient handling of costly plant places a heavy responsibility on the maintenance engineer, and the problem is one worthy of consideration by all concerned.

Whether designed to our standard specification or individually built to meet the specific requirements of the customer, a Wharton Crane will meet the situation.



REPRESENTATIVES

QUEBEC & MARITIME PROVINCES: Marshall Equipment Company, Inc., 1360 Greene Avenue, MONTREAL, P.Q. (Walter M. Smith — President). MANITOBA, SASKATCHEWAN AND ALBERTA: Mumford, Medland Ltd., 576 Wall Street, WINNIPEG, Man. BRITISH COLUMBIA: Vancouver Engineering Works Ltd., 519 to 659 West Sixth Avenue, VANCOUVER, B.C.

THE WHARTON CRANE & HOIST CO. LTD.

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E.I.C.

Technical Papers

The Institute maintains a fund for the separate publication of high-calibre original technical papers. Interest in such papers is limited to a relatively small audience of specialists in the subjects to which the papers relate, and it is not economically sound to publish them in the *Journal* which aims at the interest of some 14,000 engineers in all branches of the profession.

It is an obligation of the Institute to publish original works which contribute to the reference literature of the profession. The Technical Papers are distributed to the world's major engineering societies and technical libraries. Similarly it is an obligation of those engineers qualified to write these papers to submit them for possible inclusion in the literature. The publications committee invites authors to present such manuscripts for submission to qualified reviewers and publication if warranted. Written discussion will be accepted and published as supplements.

Technical papers issued to date are:—

No. 1—Flow in Conduits and Canals:—*French and Wood.* Comprises tables and diagrams for the solution of problems of flow in open and closed channels. Price $1.50

No. 2—A Revised Manning Flow Formula:—*Blench.* A discussion of the various hydraulic flow formulae in use or proposed. The author, formerly Director of Irrigation Research, Punjab, Pakistan, and now on the staff of the University of Alberta, concludes that the Manning formula, with modifications, is the best now available. Price $1.00

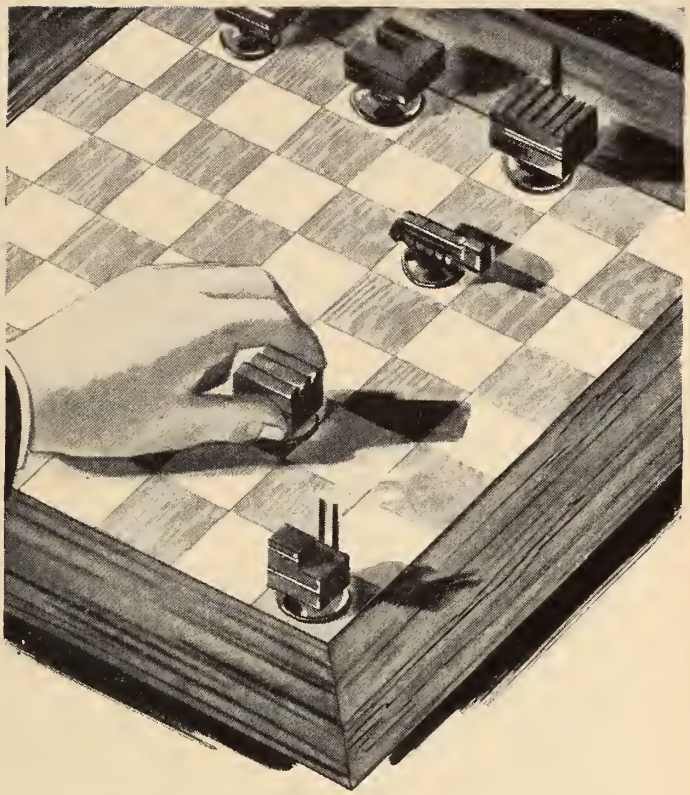
No. 3—Air Entrainment by Water in Steep Open Channels:—*Priest.* A theoretical solution of a problem of interest to hydraulic engineers. Price $1.00

No. 4—Graphical Solution of Partial Differential Equations with Engineering Applications:—*Wood.* Solution by simple, almost automatic, methods, of equations arising from the study of water hammer phenomena, impact, and other common engineering problems. This paper will be of particular value to hydraulic engineers and structural and machine designers. Price . . $3.00

No. 5—Economy in Rigid Frames:—*Monti.* Charts and diagrams to facilitate rapid preliminary design of the common types of rigid frames, eliminating the cut-and-try methods previously necessary before a final analysis could be attempted. This paper belongs in the library of every structural designer. Price $1.00

•

N.B.—Remittance with order please, payable at par in Montreal.



It's your move...

but let us look over your shoulder

You have applied all the known tests of economics and satisfied yourself that a new plant is justified . . . but you still grope uncertainly before the greatest hazard of all — a wrong location.

That is why we suggest that you let us look over your shoulder while you plan the next move, because, with a broad background of experience in this important matter of industrial placement, we could be very helpful.

From the analysis we make of your special problem, facts emerge to replace speculation and doubts give way to confidence.

You incur no obligation whatever in inviting us to study your plant location problem with you.

Dept. of Research & Development

360 McGill St.,
Montreal 1, Que.

Industrial Development Offices at

MONCTON QUEBEC MONTREAL TORONTO WINNIPEG EDMONTON VANCOUVER
NEW YORK, N.Y. LONDON, ENG. DETROIT, MICH.

the PM-18, are available from Canadian General Electric Company's Meter and Instrument section.

The new accessories include—a continuous-drive film holder for those applications which require a longer record than can be obtained with either the film pack or the polaroid land film holder—a viewing attachment for users who wish to observe the wave form before taking a record—a galvanometer with a sensitivity of 1.67 millimeters per microampere at one meter—and a new P.M.-18 sweep mirror which provides adjustable time sweep of 0.1 to 0.5 seconds in addition to the original non-adjustable 1/60-second sweep.

•

Electronic Control.—A new sulphur dioxide extraction plant commissioned late in 1951 by National Oil Refineries Ltd., Llandarcy, South Wales, Britain, to produce premium grade kerosene, is believed to be the first refinery plant in the world to be completely controlled electronically. This plant, which has since been in successful operation, is part of the Anglo-Iranian Oil Company's large development program in the United Kingdom.

Electronic measuring and control instruments which are used exclusively in the plant for flow, pressure and level, operate on the Evershed Electronic Repeater System and have been manufactured by Evershed & Vignoles, Ltd., London, W.4.

•

New Liquid Air Address.—Canadian Liquid Air Co. Ltd. have a new address. It is 2245 Vimont St., Montreal 4, Que. The new plant, stores and offices were found necessary because of a steadily growing demand for the gases, equipment and supplies manufactured and distributed by the Company. The telephone number remains the same—CL. 7741.

•

Packard Electric Expansion.—Plans for further plant expansion were announced on July 11th by Packard Electric Co. Ltd. of St. Catharines, Ont., following the formal opening of a new $1 million dollar transformer manufacturing plant.

Thomas Edmondson, president and general manager of the Company, told guests at the opening day ceremonies that the Packard expansion program called for a new $250,000 building, 300 by 60 feet, to accommodate the Company's core-cutting division. He indicated that eventually the main downtown plant would be moved to the City's new 600-acre industrial subdivision on the Queen Elizabeth Way where the transformer plant is located on a 35 acre site.

•

Stelco Nails.—The Steel Company of Canada Limited is now producing two new types of flooring nails—the spiral thread nail and the ringed nail. The spiral thread nail is made from special hard steel, to eliminate bending or breaking. They are slim and sharp pointed and do not split the tongues of hardwood flooring. Stelco ringed nails have been developed for laying underlay floors. Samples may be had on request to any of Stelco's district sales offices or from the sales division, 334 Wellington St. North, Hamilton, Ont.

•

New London Plant.—To provide modern facilities for the manufacture and distribution of Proto tools in Canada, a new factory is being erected in London, Ont. The new firm—Proto Tools of Canada, Ltd.—is affiliated with the four Proto plants in the United States, comprising one of the largest hand tool manufacturing operations in the world.

A 50-acre site in a new industrial section of the east side of London was acquired earlier this year. Ground for the factory was broken on May 20, and completion of the building is scheduled for September 1st. Initially, the plant will have a floor space of 21,000 sq. ft.

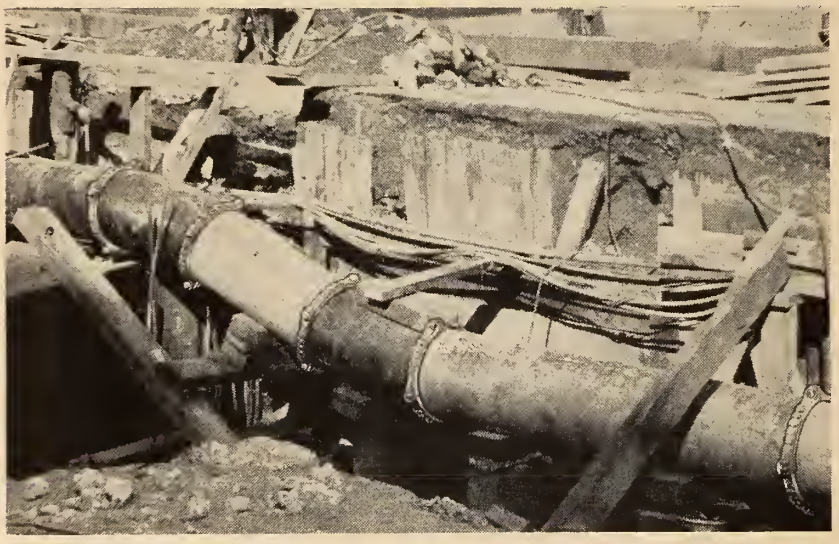
•

Transformer Oil Reconditioner.—Designed for easy installation on new or old transformers, a new Canadian Westinghouse device has been announced which maintains new oil in good condition by automatic reconditioning. Known as the Westinghouse thermosiphon oil conditioner, the apparatus consists of a cylinder containing an absorbent conditioning agent through which there is a continuous flow of oil from the transformer whenever it is in use. Operation is by temperature difference.

The cylinder is an all-welded steel tank, dome shaped at both ends, some 4 feet in length and one foot in diameter. It is mounted on the side of the transformer and is connected to the tank by suitable piping and valve assemblies.

The activated conditioning agent is placed in the cylinder and is in the form of small granules which ensures easy passage of the oil and still provides an abundant surface of contact for a thorough conditioning action. Screen shields at the top and bottom of the cylinder

VICTORY OVER HYDRAULICS



Toronto Subway piping on Front street near the Royal York Hotel.

with Victaulic

Made in Canada

Engineered for Canadian conditions

You can be SURE when it's VICTAULIC

The name Victaulic originated from the combination of VICTory and hydrAULIC and since its introduction twenty-eight years ago pipe line transportation of water, air, oil, and gasoline ceased to be a problem for engineers.

Victaulic Couplings have eliminated most of the installation and continuous maintenance problems so common to jointing practices of yester-year by combining in a single low-cost joint the advantages of a lock joint . . . with allowance for contraction and expansion: a flexible joint . . . to absorb misalignment and vibration, and a union . . . for easy installation or removal of pipe, valves or fittings.

FLEXIBLE PIPE COUPLINGS VICTAULIC FULL-FLOW PIPE FITTINGS

Victaulic Company of Canada Limited 406 Hopewell Avenue, Toronto 10, Ont.

keep the activated material in the device. For complete details, communicate with any office of the Canadian Westinghouse Co. Ltd.

●

New Exide Plant.—Exide Batteries of Canada Limited are building a new plant on a 10 acre site recently purchased on Warden Avenue in Scarborough, Ontario. The building, which will contain approximately 75,000 sq. ft. of floor space, will be used for the manufacture of Exide's complete line of industrial storage batteries. Construction started early in July and it is anticipated that the new plant will be in operation early in the second quarter of 1953.

●

Shawinigan Chemicals Expansion.—The stainless steel division of Shawinigan Chemicals Limited has applied to civic authorities for a permit to extend its foundry, increasing its capacity by about 30 per cent.

The project calls for a total investment of about a quarter-million dollars. The extension will run 150 feet northward, from the present foundry, which is located at the northern end of the Shawinigan Chemicals plants bordering the St. Maurice River. It is to have a width of 80 feet.

●

Investment in Avro.—The Hawker Siddeley group has made a further investment of $3 million dollars in Avro Canada Limited bringing the total investment made in the Canadian Company, in shares, to $10 million dollars.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Fire Fighting Film.—Walter Kidde and Company Limited, 6975 Jeanne Mance Street, Montreal are Canadian distributors of a new 18 minute, colour, sound film entitled "Not Too Hot To Handle". The film demonstrates approved fire extinguishing equipment and procedures for Class A, B and C fires.

During the film, professional technicians use all recognized types of portable extinguishers. Wood, flammable liquid, and electrical blazes are put out in seconds by the application of the proper extinguisher in an approved method.

To obtain a showing of the film write to the Company at the address given above.

●

Motor Operated Relay. — Canadian Line Materials Limited, Toronto 13, Ontario, offer a 4 page data sheet "Clemtrol Motor Operated Relay". The control is designed especially for use on multiple street lighting units, using either pilot wire or cascade connections. It is also suitable for water heater control and similar applications. It is intended for outdoor installation on either crossarm or pole structure. Copies of the data sheet will be forwarded upon receipt of requests which should be addressed to the company.

●

Equipment Rental Guide. — Canadian Construction Association, 384 Bank Street, Ottawa, Canada, offer a National Construction Equipment Rental Guide.

This 68 page booklet entitled "Rental Rates on Contractors' Equipment" lists equitable rental rates under average conditions for more than 100 basic types of equipment which are commonly used in the general contracting field, together with a break-down of the various items of expenses which combine to produce the rates listed.

The Association undertook the sponsorship of this publication in recognition of the general need for a schedule of rates applicable to the industry throughout Canada. The full-time services of a professional engineer were devoted to the compilation of data over a six month period. Copies of the booklet may be obtained from the headquarters of the Association at the address given above. The cost is $2.00 per copy.

●

Four Rope Buckets.—Blaw-Knox Company (Bucket Department), Pittsburgh, Penn., have released a forty-four page bulletin No. 2392 on Four Rope Bucket.

One of the features is a list of ten vital items for guidance of a prospective

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THE FOUNDATION COMPANIES offer a complete Soil Engineering Service backed by over forty years of soil investigation experience.

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purchaser of a four-rope bucket. It explains how to prepare an enquiry.

To assist the user, helpful information and diagrams are presented on four rope bucket types, reeving, arrangement of cables for various types of cranes, cable life as influenced in payload through use of anti-fraction bearings in bucket sheaves.

Copies may be obtained by writing to Bucket Department, Blaw-Knox Division, Pittsburgh 30, Penn.

Heating Units. — Canadian Allis-Chalmers has released a new "Thermo-Deck" heating unit bulletin.

A description of how the "Thermo-Deck" heating unit for vibrating screens eliminates blinding of medium or fine screen cloth is contained in this new bulletin.

Applicable to vibrating screens handling fine, moist materials that have a tendency to adhere to the screen surface, the "Thermo-Deck" heating unit eliminates the need for pounding, brushing or applying flame heat to the screen. Copies of the bulletin may be obtained by writing to Canadian Allis-Chalmers (1951) Ltd., P.O. Box 37, Montreal, Que. Ask for Bulletin No. 07B7812.

Centrifugal Pumps. — Kenco Incorporated, 1125 North Ridge Road, Lorain, Ohio, announce the distribution of a specification folder describing the new Model P-104 All-Purpose Centrifugal Pump.

This new pump is the most recent design in the Kenco line and features a completely submersible pump, hermetically sealed, that will handle a wide variety of liquids. It is particularly suited for many coolant applications in industrial plants. For copies of the folder write to the Company.

Current Events.—"Industry Tomorrow" is the title of a monthly bulletin issued by Morris and Van Wormer, engineers, of New York. The April 15th issue which has been forwarded as a sample contains articles on "Soviet Bloc Shows Signs of Manpower Shortage"—"International Sales Through Investment", "Management-Science and Art"—and a chart is given to show significant trend in a business and industry. For copies of the publication write to the Company at 25 Broad Street, New York 4, New York.

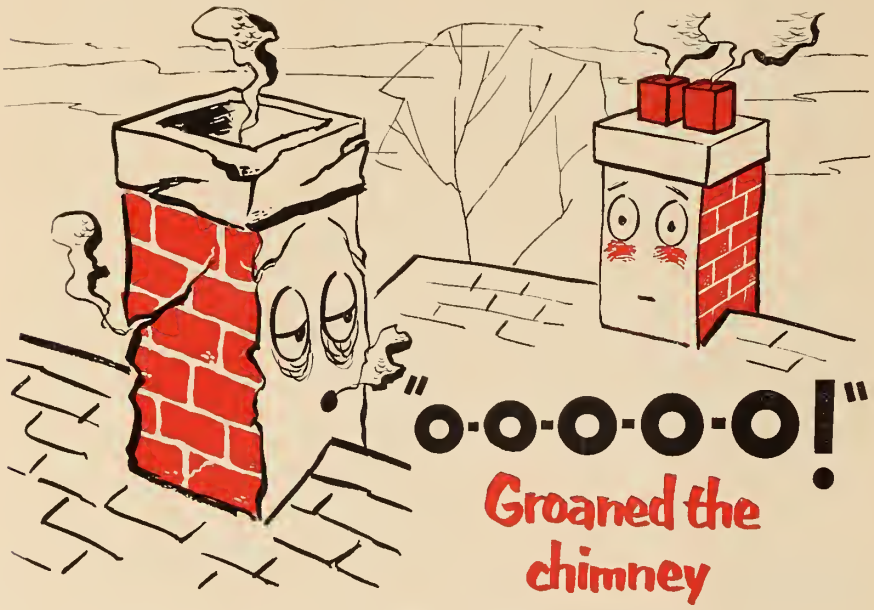
"Dominion Engineer".—No. 3 of Volume 19 of the "Dominion Engineer" contains a very interesting article "Diesels for the Interprovincial Pipe Line". The author is E. C. Tucker, field engineer for the Company's Diesel Division. For copies of the bulletin write to Dominion Engineering Company Limited, P.O. Box 220, Montreal, Que.

Fire and Moving Stairways.—The National Bureau of Standards, U.S. Department of Commerce, Washington 25, D.C., have issued a new publication "Fire Resistance of Shutters for Moving-Stairway Openings". The authors are Nolan D. Mitchell, Edward W. Bender and James V. Ryan. There is a nominal cost of ten cents for the publication and in the covering letter which accompanies the sample copy it is stated "Foreign remittance must be in U.S. exchange and should include an additional one-third the publication price to cover mailing costs". Address request to the Government Printing Office, Washington 25, D.C.

Electrical Measuring.—A new catalogue of precision electrical measuring instruments has just been issued by Sensitive Instrument Corporation. This 164 page book lists an extremely wide range of laboratory voltmeters, ammeters and wattmeters including the multirange units for which sensitive research has been done for many years. A request, on Company letterhead, addressed to Canadian Research Institute, 46 St. George Street, Toronto 5, will receive prompt attention.

Atlas Steel News.—No. 3 of Volume 5 of Atlas Steel News published by Atlas Steels Limited, Welland, Ont., describes the Company's latest activities in the field of steel production and distribution. To be placed on the mailing list for regular receipt of this publication address applications to the Company.

Wood Preservation.—Monsanto Chemical Limited, 425 St. Patrick Street, Ville LaSalle, Montreal, are Canadian distributors of a 40-page booklet "Your Answer Book on Penta Wood Preservation". This is a very informative publication and should be extremely useful



"I feel so bad I think I'm going to collapse."

"What's the matter?" asked his friend on the next roof. "You certainly look sick."

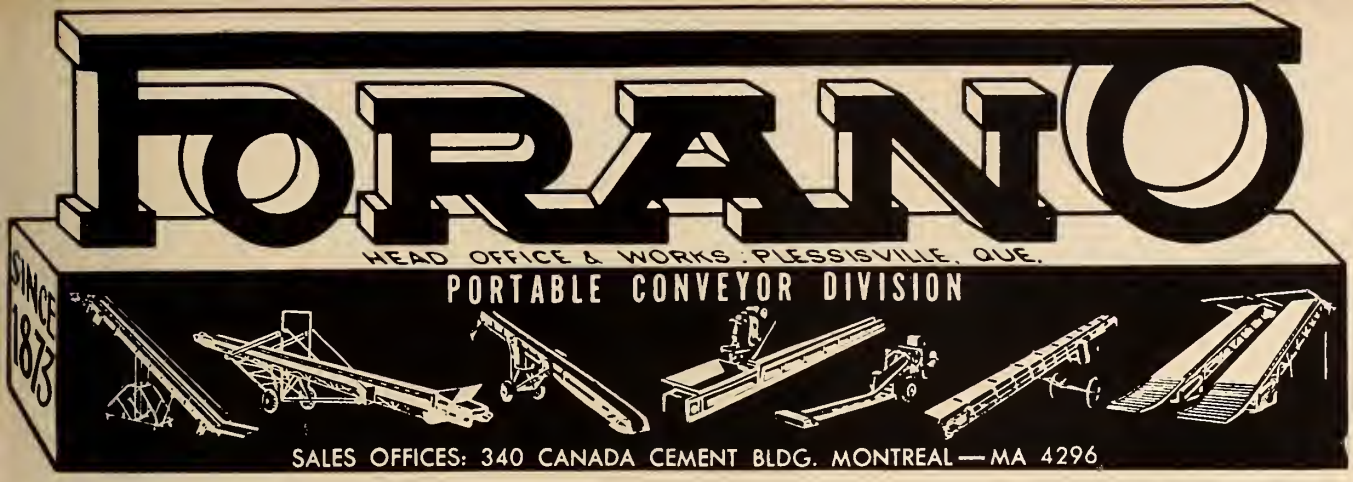
"I feel all weak and wobbly. My mortar is crumbling, and my bricks are beginning to fall out. Flue gas is playing hob with me. It gets caught in my bends, seeps through my mortar-joints, and—look at me. Would you call that a healthy complexion?"

"You certainly are a bad colour," replied his friend. "I think I know what's wrong with you. Look at me. Did you ever see a healthier chimney? Well, I have Vitrified Clay Flue Lining in my inside, and factory-made offsets at each turn. Keeps me protected from combustion acids. You don't find MY mortar crumbling, or MY complexion getting mottled."

Take the Healthy Chimney's advice. Insist on VITRIFIED CLAY FLUE LINING AND FACTORY-MADE OFFSETS at each change in direction. They give permanent protection against corrosive action of flue gases and assure the life of your Chimney REGARDLESS OF THE TYPE OF FUEL USED.

VITRIFIED CLAY PIPE INDUSTRY
BONDED BY FIRE

12-2



to engineers interested in the preservation of work.

•

Humidity Control. — Surface Combustion Corporation, Toledo 1, Ohio, has released an eight page bulletin describing a number of installed applications of Kathabar humidity conditioning equipment. Seventeen industries and forty-three business and manufacturing firms in which this dehumidifying equipment is used are mentioned.

Copies of ths bulletin "Humidity—Engineered to Order" may be obtained by writing, on Company letterhead, to Surface Combustion Corporation, Toledo 1, Ohio.

•

Scotch Dry Back Boiler.—Dominion Bridge Co. Ltd., P.O. Box 280, Montreal, Que., have published a completely revised catalogue in connection with their Scotch Dry Back boiler. The Company is now in a position to provide complete data for both high pressure and low pressure types. To obtain copies of this highly informative booklet, write to the Company at the address given above and ask for publication No. B. 111.

•

Office Partitions. — Westeel Products Limited, 2-28 Atlantic Ave., Toronto, Canada, offer a new catalogue No. 34 covering their office partitions. This catalogue is very well produced and highly informative. It contains construction data, and illustrations and descriptions of the various types of partitions available and suggestions as to their uses. Dimensioned sketches are included. To obtain copies of this publication, write to the Company at the address given above. Ask for catalogue No. 34.

•

Selenium Rectifiers.—Richardson-Allen of Canada Limited, 370 Victoria St., Toronto, offer new catalogue sheets pertaining to Richardson-Allen selenium rectifiers for electroplating and anodizing and Richardson-Allen selenium rectifiers for power conversion for d-c industrial applications.

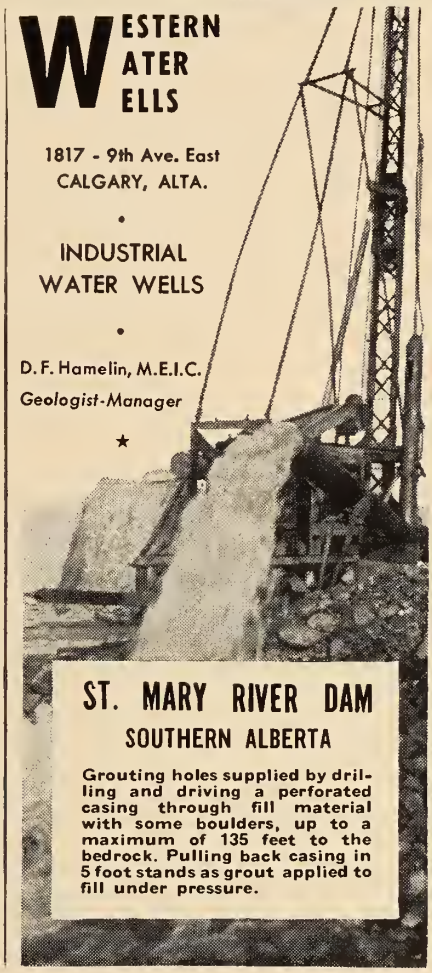
A third bulletin is devoted to the automatic chargers for industrial truck batteries manufactured by the parent Company. Write to the Canadian Company for copies of these bulletins.

•

Sludge Plant Data.—A new Application Engineering Data Sheet, issued by The Foxboro Company, Foxboro, Mass., describes how modern instrumentation controls air and return sludge, the two important and troublesome variables in the operation of municipal and industrial activated sludge plants. Full details and a complete description of the process are contained in AED 833-9, available upon request from Peacock Bros. Ltd., Ville La Salle, Montreal, P.Q.

•

Street Lighting.—Canadian Line Materials Limited, Toronto 13, Ont., have just released a bulletin which provides in brief form data and information that will assist in the correct selection of street lighting service equipment. The contents include aerial maintenance ladders, for truck mounting where mobile equipment is required, and a wide range of lamp replacers. Another item



Filtered POWER TRANSMISSION

FALK STEELFLEX COUPLINGS keep these monkey wrenches out of connected machinery

Right there — in the grid-groove members of FALK Steelflex Couplings — the damaging effects of shock and vibration are absorbed, and power flows on to connected machinery smoothly and efficiently.

Shock loading of a machine may be unavoidable. Vibration may be necessary. The torsional resilience of the grid-groove members of FALK Steelflex Couplings filters them out, prevents their effects being passed on to connected machines.

FALK Type F Steelflex Couplings are applicable to more than 90% of all industrial installations. For special services and dual-purpose applications other FALK Flexible Couplings are available.

Ask for Bulletin No. 4100 for details

THE WILLIAM KENNEDY & SONS LIMITED

A DIVISION OF MILLSPAUGH LIMITED, SHEFFIELD, ENGLAND

OWEN SOUND, ONTARIO

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WELDED CYLINDRICAL TANKS

. . . . . for pressure storage

The above view shows four cylindrical tanks we built for Dominion Foundries and Steel, Limited at their Hamilton, Ontario, plant for the storage of butane or propane. The liquefied petroleum gas is used to anneal cold roll strip, heat tin pots, etc.

The four storage tanks are 8-ft. 10-in. diam. by 67 ft. long and are designed for pressures as high as 200 lbs. per sq. in. When considering the installation of pressure tanks write our nearest office for tenders or information.

HORTON STEEL WORKS LIMITED

TORONTO, ONT. FORT ERIE, ONT. MONTREAL, QUE.

REPRESENTATIVES

Mumford-Medland Ltd., Winnipeg, Man. · Gordon Russell Ltd., Vancouver, B.C.

MARGISON BABCOCK and ASSOCIATES Limited

CONSULTING PROFESSIONAL ENGINEERS

SPECIAL PROJECTS ORGANIZATION

21 Richmond St. W., Toronto (Head Office) 10053 Jasper Ave., Edmonton

COMPLETE DESIGN OF INDUSTRIAL PROJECTS

Site Services and Facilities
Building and Building Services
Process and Process Services

SUPERVISION OF CONSTRUCTION

described in the new bulletin is a concentrated solution for "dip cleaning" street lighting glassware. Write to the Company for copies.

●

Wood Preservation Film. — Dow Chemical of Canada Limited, 204 Richmond St. West, Toronto 1, Canada, have released a film designed to arouse public interest in wood preservation.

"Treat Wood Right." A twenty minute coloured film is the first production to go into the actual processes of wood treating. It begins with scenes taken in forests in the Great Lakes region and presents the problems of decay which begin from the moment the tree is cut. To arrange for showing of the film, write to Dow Chemical of Canada Ltd., The Dowicide Department, Toronto, Ont. Mention the film "Treat Wood Right".

●

Garlock Packing.—A new 8 page bulletin outlining the advantages of Lattice-Braid rod packing has just been issued by The Garlock Packing Company Limited. The bulletin contains sectional drawings showing the unique structure of Lattice-Braid Packings, illustrations of different types, tables showing general service recomendations and specifications and reports from users. Copies of this Lattice-Braid Bulletin may be obtained by writing to the Garlock Packing Company Limited at any one of the following addresses:

133 Sixth Ave., West, Calgary, Alta.

200 Queen St., North, Hamilton, Ont.

637 Craig St., West, Montreal, Que.

750 Bay St., Toronto, Ont.

1925 West Georgia St., Vancouver, B.C.

1373 Portage Ave., West, Winnipeg, Man.

●

New Fluorescent Lamp.—To meet the trend toward larger manufacturing spaces, higher mountings and higher lighting levels both indoors and outdoors, the Canadian Westinghouse has made available a new 1000-watt, C-H12 fluorescent mercury lamp. Essential technical data will be mailed upon request by Lamp Sales Information Department, Canadian Westinghouse Co. Ltd., Hamilton, Ont.

●

Diesel Servicing.—Russel-Hipwell Engines Limited, Owen Sound, Ont., offer a bulletin which gives information on the trained personnel on the staff of the Company who give service.

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NECHAKO - KEMANO - KITIMAT

Hydro-Electric Power Development and Aluminum-Reduction Plant

F. L. Lawton, M.E.I.C. *and* J. S. Kendrick, M.E.I.C.

Chief Engineer, Power Department, Aluminium Laboratories, Limited,

Assistant Manager, Project British Columbia, Aluminum Company of Canada, Limited.

A paper presented before the Sixty-sixth Annual General and Professional Meeting of The Engineering Institute of Canada, Vancouver, B.C., May 7-9, 1952.

The largest hydro power development ever financed by private enterprise is being built in British Columbia by the Aluminum Company of Canada. When completed, it will have the biggest underground power house, the greatest firm energy output, the highest capacity impulse type turbines and largest pressure conduits anywhere in the world. Installed capacity will be the second largest, rock filled dam the third highest, reservoir the third largest, on the earth's surface. Transmission lines will have the highest voltage power cables in North America and highest system loading in the world. The conductors will be the biggest ever fabricated. It will serve the world's largest aluminum smelter.

In this article the authors describe the project, some of the unusual problems encountered, and discuss the design and the methods of construction.

The Nechako-Kemano hydro-electric power development in west central British Columbia, with the power-transmission facilities and the aluminum-reduction plant at Kitimat, marks an outstanding event in the amazing industrial development of aluminum, ranking among the five most widely-used metals in the world, second in volume and only exceeded in tonnage by steel, copper, lead and zinc.

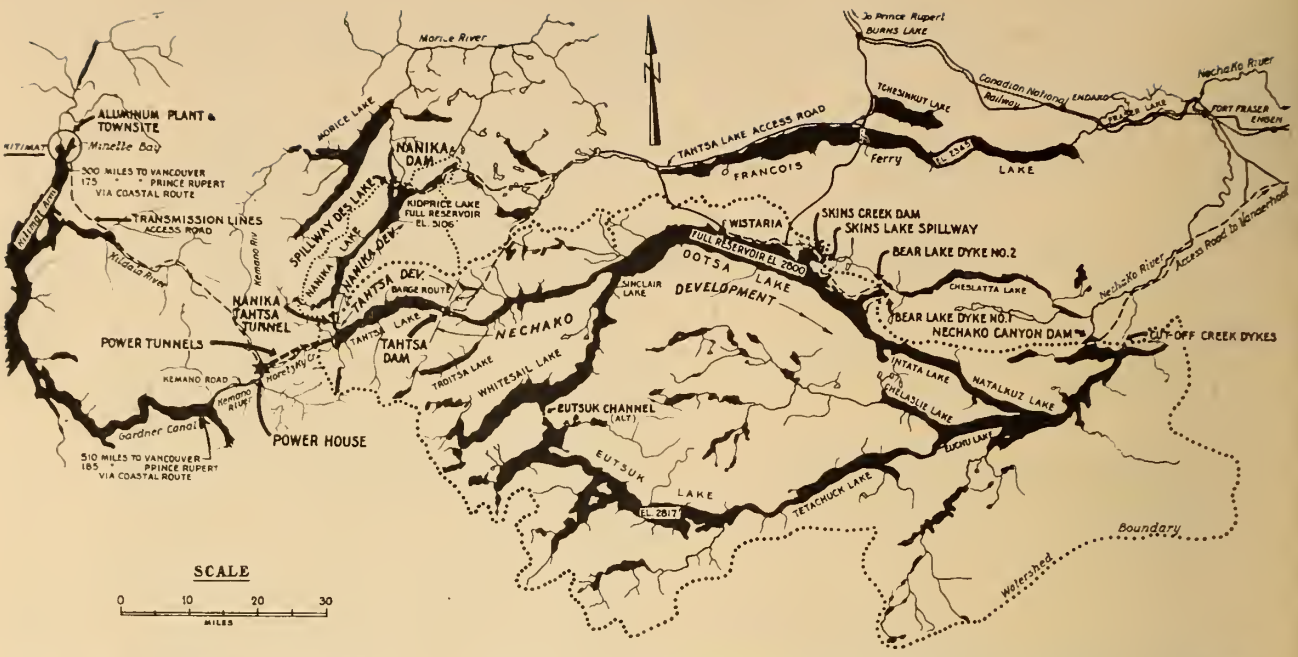
Bauxite, the basic ore of aluminum of commercial grade, is found only in the tropical and sub-tropical zones, although some deposits of limited volume do occur in areas fringing the sub-tropics. About 4 lb. of bauxite are required per lb. of aluminum. The production of aluminum ingot requires some 10 kwh. per lb. of metal. Other raw materials amount to roughly six times the weight of aluminum ingot. Here, then, are two of the basic ingredients entering into aluminum—cheap power and cheap transportation.

The first requires large blocks of cheap hydro-electric power, the basis on which the aluminum industry has been built. Historically, the industry has located where cheap water power was available, developing the surrounding community as an inevitable by-product. In time, the power has become more valuable for other industries requiring less energy per unit of product, and the aluminum industry has had to look elsewhere for its power.

The first great development of the aluminum industry in the U.S.A. was at Niagara Falls, but no aluminum is made there today. The industry went to water power at Baden and Alcoa, then to the Pacific Northwest, to use Columbia River power. With cheap water power in sufficient quantities unavailable, it has turned to natural gas, a fuel for diesel engines or steam-power stations, as at Point Comfort in Texas and Chalmette in Louisiana. A late development is the use of low-grade lignite fuel, after processing, in the steam-power plant serving the new Texas reduction plant of Alcoa.

In Canada, the industry had its beginnings in 1900, when the construction of the first aluminum-reduction plant was started at Shawinigan Falls in Quebec. As the industry expanded, it turned to the water-power resources of the Saguenay River in Quebec. The first aluminum was produced at Arvida in 1926, in a plant which is today the world's largest. The expansion of Canadian aluminum production during World War II involved the building of additional smelter capacity and the completion of the Shipshaw power development, the first stage of which was commenced in 1926. The final stage of the Shipshaw power development comprised the construction of the 1,200,000 hp. No. 2 generating station, and brought the total development up to 1,500,000 hp. The current expansion program in the Saguenay entails about 500,000 hp. now under construction at two sites on the Peribonka River, the principal tributary of the Saguenay.

The second requirement for the economic production of aluminum is cheap transportation. At present the bauxite used at the Arvida aluminum-reduction plant is mined in British Guiana, shipped to Arvida and there processed to alumina. However, Kitimat will use bauxite deposits now being developed in Jamaica, processed to alumina in the plant being erected nearby, and shipped to the aluminum-reduction plant by ocean freighter, through the Panama Canal and up the Pacific coast. Cryolite from Greenland, fluorspar from Newfoundland and elsewhere, and the other raw materials for aluminum ingot, from



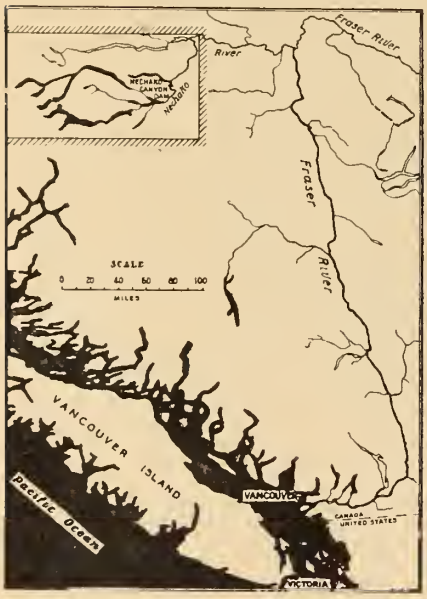


Fig. 1. General plan showing Nechako-Kitimat hydro-electric power development and its relationship to Kitimat.

many sources of supply, also require ocean transport.

Large aluminum-reduction plants require many thousands of workmen, with necessary homes, schools, churches, recreational facilities and all the needs of a modern well-balanced community. Thus, ample suitable space for plant and community must be available.

Since World War II, the demand for aluminum has exceeded present world capacity. Over the past 25 years the consumption of aluminum has increased 9 per cent cumulatively per annum, with the probability the growth trend will continue upwards. Of Canadian production, only about 15 per cent is consumed in Canada, the Canadian exports in 1950 ranking fourth among all exports, only newsprint and other forest products, wheat, and nickel leading it.

Cheap water power and cheap transportation, together with suitable plant and townsite areas, do not ordinarily occur side by side. All possibilities have to be weighed in the balance. Considerable time is required for the development of power and reduction-plant facilities, once a decision is reached to develop a power site. That is why Aluminium Limited has for years sought out and developed bauxite resources, and investigated potential water powers all over the world, in order to supply the growing demand for aluminum.

This growing demand arises from the unique properties of aluminum. It is light, weighing about one-third as much as iron, copper or zinc. It is durable, non-rusting and highly resistant to atmospheric and chemical attack, other than alkali. It is soft, malleable and ductile, so that it is adaptable to most working processes, such as hot and cold rolling, extruding, forging, pressing, drawing, stamping, bending, shaping and casting. It is readily joined by welding and brazing. It has an excellent heat conductivity, so that it is widely used for kitchen utensils. It can be readily and economically treated to produce many attractive finishes and colours. It is adaptable to alloying to yield a tensile strength equal to that of mild steel and many other desirable properties, so that today its end uses are well in excess of 4,000.

That is why the Aluminum Company of Canada, Limited (commonly known as Alcan), the principal producing subsidiary of Aluminium Limited, is today well advanced on the construction of the Nechako-Kemano hydro-electric power development, the aluminum-reduction plant at Kitimat and related facilities such as harbour and townsite, and the transmission system linking the power plant and the reduction plant. With an ultimate firm delivery at Kitimat of 1,670,000 hp. and installed capacity of 2,240,000 hp., the decision of Aluminium Limited early in 1951 to proceed with the first stage of the overall project constitutes a notable milestone in the growth of the aluminum industry. This decision marked the start of construction on the greatest hydro-electric power development ever financed by private capital.

With 10 kwh. of electrical energy from water-power resources going into each pound of aluminum ingot from Kitimat, along with the necessary ingredients of cheap transportation, skilled labour, engineering knowledge, industry know-how and financial courage, Nechako-Kemano-Kitimat truly can be termed a producer of packaged hydro power, for distribution to the free world.

On April 21, 1951, the decision was reached to proceed, on the basis of a power development involving equipment for 450,000 hp. of the initial stage of the ultimate 1,670,000 hp. firm capacity, transmission facilities, aluminum-reduction plant, townsite, and port.

Access

Means of access to the Nechako-Kemano-Kitimat development is an important consideration, because transportation of men, materials and equipment will be a substantial item of construction cost. The powerhouse site, 10 miles from Kemano Bay, part of the transmission-line route skirting Kildala Arm and the aluminum-reduction plant and townsite can be readily reached by sheltered ship channels from either Vancouver or Prince Rupert. Vancouver is 500 statute miles by water from Kitimat, the same distance from Kildala Arm and 510 miles from Kemano Bay; Prince Rupert is 175 miles by water from both Kitimat and Kildala Arm, and 185 miles from Kemano Bay. Vancouver and Prince Rupert are natural bases of operation, being connected by highway, railway and air lines. Vancouver is also a manufacturing centre for much of the heavier material and equipment needed in the development.

Access to the storage and diversion dam at the head of Nechako Canyon, control and cut-off dams, works at the outlet of Tahtsa Lake, the Nanika-Kidprice storage and diversion dam, and diversion tunnel to Tahtsa Lake, the intake works and the east end of the power tunnels is based, in the first instance, on the Canadian National Railway line from eastern Canada to Vanderhoof, Burns Lake and Prince Rupert. A public road runs south from Burns Lake 12 miles to Francois Lake, thence around the west end of the lake and southeast to Ootsa Lake. Ootsa Lake can also be reached by a more direct route from Francois Lake via a car ferry, with a 5-ton gross load limitation.

The supply route for all work at the outlet of Tahtsa Lake, the east portal of the power tunnels, and eventually for work on the Nanika-Kidprice stage of development, is a road from the west end of Francois Lake to the east end of Tahtsa Lake. The distance from Burns Lake to Tahtsa Lake by road is about 110 miles. On Tahtsa Lake transportation is effected by 40-ton steel barges. Kenney Dam, the main storage and diversion dam at the head of the Grand Canyon of the Nechako, is supplied over a 60 mile road built in the spring of 1951 from Vanderhoof to the damsite. A landing strip suitable for medium planes is also available at this site. The spillway and saddle dam at Skins Lake and the saddle dams at Bear Lake will be reached by road, branching from the existing public road near Ootsa Lake.

A pier at Kemano Bay completed in late 1951, and a 10 mile road from the pier to the powerhouse site at the confluence of the Kemano River and Horetzky Creek, built before the 1951 spring freshet, serve construction operations at the power plant and the power tunnel driving, both from the west portal and the Horetzky Creek adit. Approximately midway, this adit is reached by a road up the Horetzky Creek. That part of the transmission lines running up the Kemano River from the power plant to Kildala Pass will also be served from Kemano Bay.

A weekly service to Kemano Bay became available in late 1951, coastal steamers from Vancouver calling on a regular schedule. At Kitimat, coastal steamers dock at a wharf built in the summer of 1951. An agreement with the Canadian National Railways provides for the construction of a railroad connecting at Terrace, 40 miles away, with their line from the East to Prince Rupert.

The transmission lines will be accessible from tidewater shipping at Kitimat and Kildala Arm. In addition to a road running at least nine miles along the transmission lines from the power plant, there will be a road at least 31 miles from Kitimat to a point on the upper Kildala River. Much of this road mileage has been already constructed. Where the transmission lines cannot be served by roads, in the Kildala Pass, transportation will be effected by cableways, high-lines and helicopter. During the investigation in 1948-50, inclusive, air transportation was the backbone means of access. It is still used for emergencies and time-saving purposes. Helicopters have been widely used in connection with the transmission-line surveys, and will be used to a considerable extent in the Kildala Pass construction.

Access to the west end of the power tunnels, and to the centre adit used for construction of the pressure conduits, is by heavy aerial tramway from the powerhouse site. The Horetzky Creek adit to the power tunnels is supplied over a road running up Horetzky Creek from the powerhouse site. Emergency transportation is effected by means of helicopters.

Physiographic Setting

On the western slopes of the majestic Coast Range mountains most of the valleys reach sea level close to or somewhat east of the crest, constituting the great fjords which sharply indent the coast line. Similarly, large valleys on the eastern slopes of the range are occupied by long, narrow and deep lakes, with westerly extremities close to the crest, extending out over the Interior Plateau.

Here we see an unusual topographic development, in which the deep valleys of the western slope head inland to within a few miles of the shallower lake-occupied valleys on the eastern slope. It arises from the heavy glacial action to which the region was subjected in times past, when the whole of British Columbia,

J. S. Kendrick, M.E.I.C. (left), and F. L. Lawton, M.E.I.C. (right), co-authors of this paper, with their session chairman, W. J. W. Reid, M.E.I.C., at the annual meeting.

Artist's conception of how the completed harbour, smelter and townsite will appear. The townsite, which is four miles up the Kitimat River from the smelter, is planned to house as many as 50,000 people.

except the highest peaks, was covered by a continuous ice cap. It creates the water power which is being harnessed in the Nechako-Kitimat development.

By damming the Nechako River near the head of the Grand Canyon, a great storage reservoir (Fig. 1) will be created which will impound the run-off of the Eutsuk-Tetachuck-Euchu and Tahtsa-Whitesail-Ootsa-Natalkuz drainage systems, at full reservoir level at El. 2,800 (2,800 ft. above sea level). This permits the flow to be reversed through Tahtsa River and Lake and diverted through power tunnels piercing the Coast Range (Fig. 2).

Study of the precipitation pattern indicates that the higher westerly portions of the watershed receive a precipitation of 100 in. or more, mostly snow; the lower, easterly part, from the head of Ootsa Lake, about 20 in. Along the transmission-line route average precipitation of 100 in. or more is anticipated. During the winter of 1950-51, a maximum depth of snow of 66 in. was recorded at El. 3,000 in the Kildala Valley; 48 in. in the lower Kildala Valley; about 60 in. at Kitimat mission.

Working conditions during the winter months are difficult, and most surface work can only be carried out efficiently during six to eight months of the year. Twelve-month operation has been necessary on most construction phases, in order to meet schedules, but work on the transmission lines has to be virtually suspended for four months because of weather, snow slides, and freezing of Kildala Arm. Construction on the Kildala Pass section of the transmission system will be concentrated during July, August and September.

Run-off and Regulation

The area of the watershed above the storage and diversion dam at the head of the Grand Canyon of the Nechako River is 5,475 square miles. That for the Nanika-Kidprice Lakes watershed, which can be added to the former by diversion, is 290 square miles. Careful analyses of flow data has indicated that the 20-year mean (1930-50) discharge of the Nechako River system at the Kenney Dam, not including water from the Nanika-Kidprice watershed, is 6,495 c.f.s.

The minimum monthly average flow of record during the 20-year period was 1,060 c.f.s.; the maximum 25,620. The minimum yearly average flow during the same period was 4,490 c.f.s.; the maximum 8,510. The average flow during the same 20-year period, by component watersheds, was:

Tahtsa	940 c.f.s.
Nechako, excluding Tahtsa	5,555 c.f.s.
Nanika-Kidprice .	975 c.f.s.

For the first stage of development, using Tahtsa Lake waters only, 10 billion cubic feet are required to fill the reservoir. For the Nechako reservoir necessary to further stages of development about 845 b.c.f. are required to fill the reservoir to El. 2,800. The Nanika development requires 18 b.c.f. Figs. 2 and 3 illustrate how the several components of the lake-and-river system contribute to the reservoir area and capacity, totalling about 358 sq. mi. and 873 b.c.f. respectively.

The first stage of development will entail a draft of 1,040 cu. ft. per second from May 1, 1954. This exceeds the firm supply of water from Tahtsa Lake by about 100 cu. ft. per second. With the Kenney Dam diversion tunnel closed September 1, 1952, an inflow to the reservoir equal to the 20-year mean monthly discharges will provide sufficient water to maintain the required 1040 cu. ft. per second and will fill the reservoir by June 1, 1957. This is the underlying reason for starting construction on the Kenney Dam diversion tunnel early in 1951, to which further reference is made.

The estimated variation in level of the Nechako reservoir, without the Nanika-Kidprice diversion, will result in an annual average reservoir level at El. 2,795, with an overall variation under average conditions of about 6.5 ft. Under minimum water conditions the reservoir may be drawn down about 17 ft. The regulated flow available for power development has been estimated at:

From Tahtsa . . .	925 c.f.s.
From Nechako, exclusive of Tahtsa	5,075 c.f.s.
From Nanika-Kidprice	920 c.f.s.
Total	6,920 c.f.s.

Head and Power

The annual average reservoir level is 2,795. The water surface in the Kemano River, into which the waterwheels discharge, fixes a turbine nozzle setting at El. 210. Consequently, the gross head on the turbines, under average reservoir level, is 2,585 ft.

The complete Nechako-Kemano power development comprises three possible phases, for which the basic hydraulic data and power available are given in Table I.

With 6,920 c.f.s. of water available under a net head of 2,497 ft., an estimated 1,718,000 hp. can be generated, the installed capacity being 2,240,000 hp. in 16 units.

Storage, Diversion and Control Dams

Fig. 1 shows the location of the several storage, diversion and control dams required in the creation of the 20,000,000 acre-feet storage

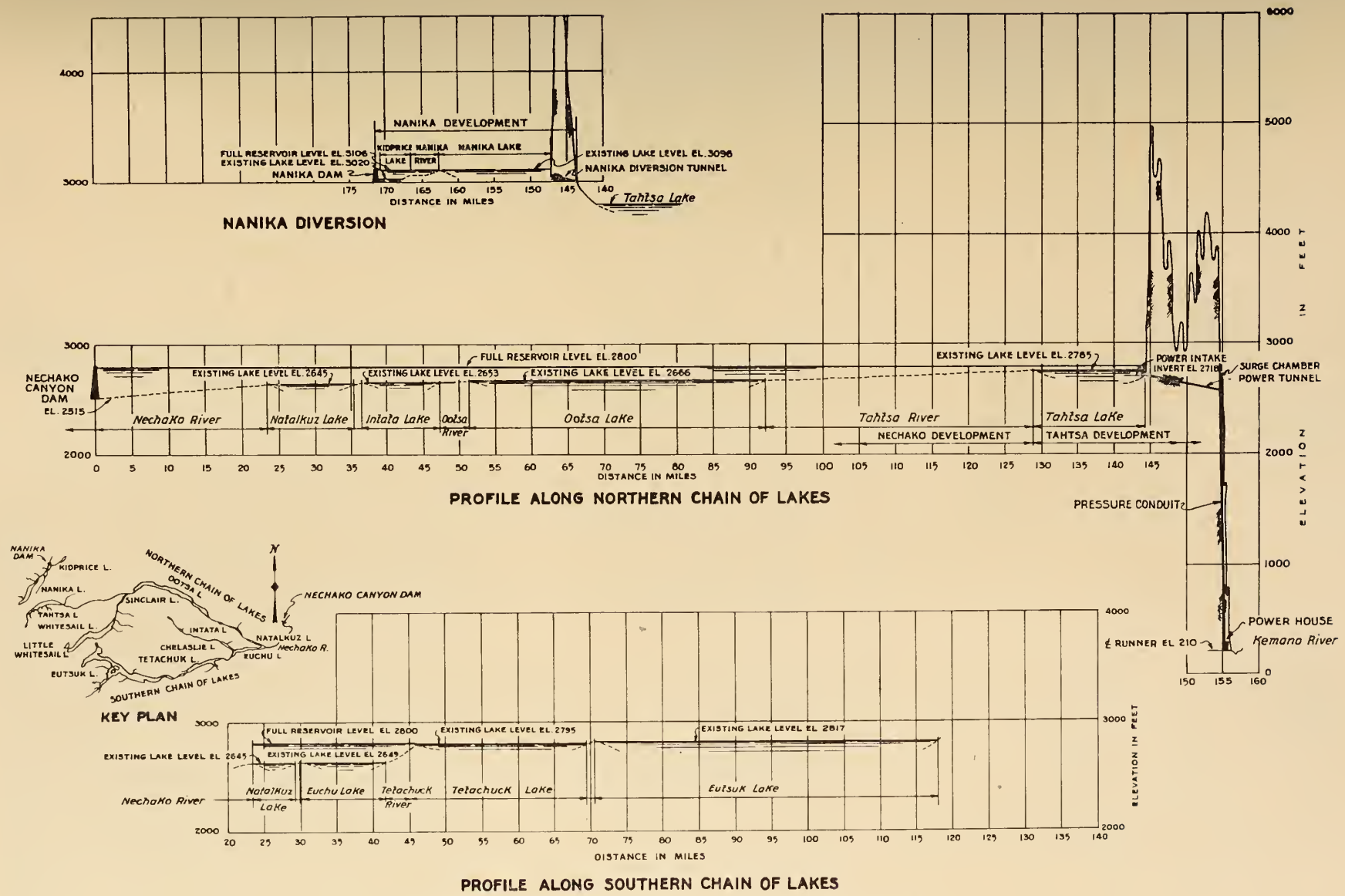


Fig. 2. Longitudinal profile of the Nechako reservoir lakes.

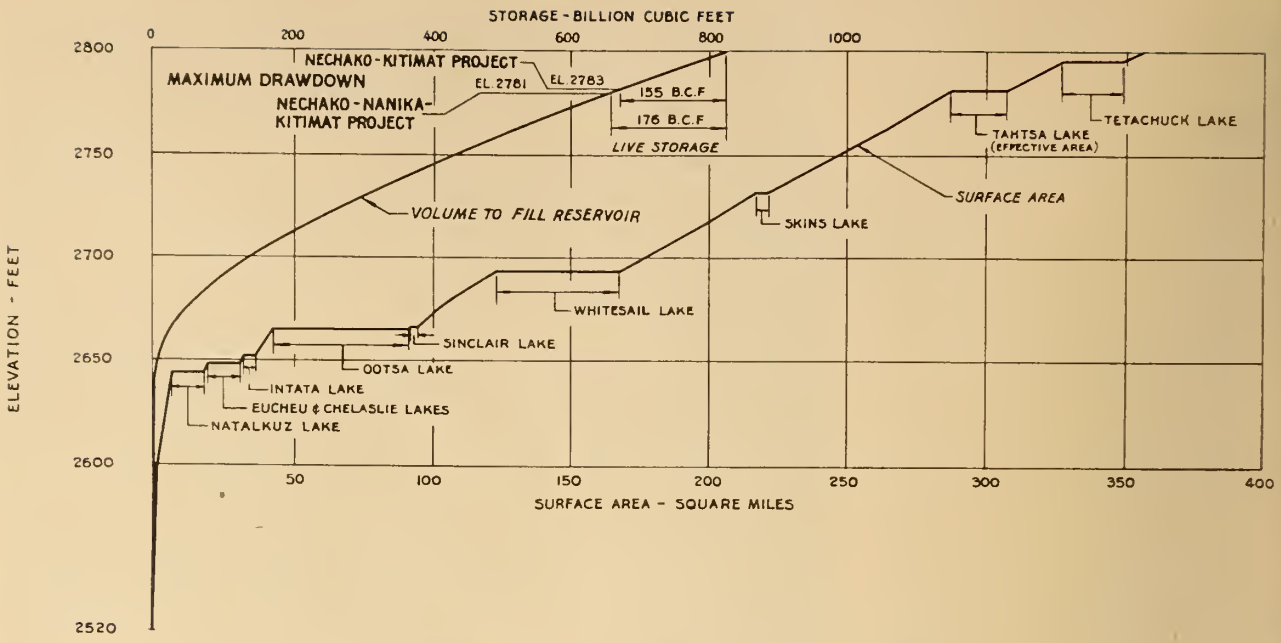


Fig. 3. Area and capacity curves for the Nechako reservoir.

reservoir, whereby the run-off of the tributaries of the Nechako River is impounded and raised to full reservoir level at El. 2,800. The reservoir will be 15 feet above the normal level of Tahtsa Lake, through which the flow is reversed to permit diversion through the power tunnels piercing the Coast Range, thence the generating units and into the Kemano River.

Some 16 miles downstream from Natalkuz Lake, the Nechako River makes a sharp bend of 140° to the left and flows due west for nearly five miles, then makes a right-angle bend north, cutting across a volcanic ridge rising some 1,000 ft. above the general plateau level in a deep notch known as the Grand Canyon of the Nechako. Here an entirely suitable site was located. At the damsite, the exposed rock in the Canyon consists of volcanic flows and tuffs of Tertiary age, the strata being nearly horizontal but dipping slightly downstream.

At the axis of the dam, the upper surface of a formation of relatively weak tuffs and other ash rocks lies 170 ft. below the river. Above this is a coarse volcanic breccia about 150 ft. thick, overlain by a series of vessicular volcanic flows about 200 ft. thick, on which is superimposed more massive and non-vessicular volcanic flows extending far above the crest of the dam. Running parallel to the volcanic ridge and directly across the river a short distance above the damsite is a felspar porphyry dyke several hundred feet wide, extending to great depth, which acts as an effective cut-off in the underlying relatively weak tuffs and other ash rocks.

Kenney Dam

The dam will be of the rockfill type, in which the load-carrying element is a heavy rockfill, thoroughly sluiced, supporting on the upstream slope an impervious section of rolled-earth construction enclosed between suitable filter layers. The upper section will be loaded with quarry-run rock to retain the filter layers and impervious core, and resist wave erosion. The impervious core will extend from a cut-off trench in sound rock to near the top of the dam.

The function of the downstream filter layers is to prevent the impervious core material from being forced into the rockfill by the water pressure, whereas the upstream filter layers perform a similar function with respect to the upstream blanket of quarry run rock. The downstream filters will comprise three layers; immediately downstream from the impervious core a layer of sand ½ in. and smaller; next crushed rock or gravel 3 to ½ in.: and, finally, adjoining the main rockfill a layer of 10 to 3 in. selected rock. The upstream filter is similar but in the reverse sense, with the omission of the layer of 10 to 3 in. rock.

Below the impervious core, effective cut-off will be assured by a grout curtain. This grout curtain will be developed by grouting the upper 25 ft. of rock at pressures of about 20 p.s.i., then to necessary depth by deep holes drilled through the consolidated upper zone, using higher grouting pressures.

The rockfill dam being constructed, with downstream rockfill section supporting an upstream impermeable earth core, is of the Nantahala type, itself a development of a form of construction dating back over 60 years. Although the Nantahala rockfill dam was built over 10 years ago, it is the logical and most reliable design developed over almost 100 years of satisfactory performance and gradual improvement

Table I—Hydraulic and Power Data—Nechako-Kemano Development

Development Stage	Flow in c.f.s.	Reservoir Drawdown, Ft.		Average Net Head, Ft.	Installed Capacity, hp.	Generation, hp. at Generator Terminals
		Maximum	Average Annual			
Tahtsa	925	50	17	2,560	420,000	234,000
Tahtsa-Nechako	6,000	17	5	2,516	1,960,000	1,493,000
Tahtsa-Nechako-Nanika	6,920	19	6	2,497	2,240,000	1,718,000

in rockfill dams in the western U.S.A., Mexico, Chile and elsewhere.

Because of its location on a major headwater tributary of the important Fraser River, a very high degree of reliability is being built into the dam, which will have a maximum height, structurally, above bedrock of about 317 ft. at full reservoir level of 2,800 plus 7 ft. flood surcharge, being exceeded by San Gabriel No. 1 in California (1933-37) at 380 ft. and Salt Springs in California (1931) at 328 ft. approximately. Freeboard at the abutments will be 12.5 ft., with a super elevation of 5 ft. at the centre of dam to provide for settlement.

Crest length is about 1,550 ft. Crest width of the dam will be 40 ft. The slope of the upstream face will be one vertical on 2.5 horizontal, increasing the overall factor of safety considerably beyond the originally contemplated 1:1.5, in view of the importance of the dam. The slope of the downstream face will average 1:1.75. This average will be obtained by a series of repose slopes and berms. The foundation of the dam will be trimmed to not exceed slopes of 1:1.5 adjacent to the impervious core, to eliminate the possibility of tension cracks in the impervious core due to differential settlement. The longitudinal axis of the dam will be given a slight camber upstream, thus putting the core under axial compression and decreasing the possibility of tension stresses in the core.

Model tests, made at the University of California, indicated the dam (with crest width of 30 ft. upstream slope of 1:1.5 and downstream slope of 1:1.4) to be free from movement (sliding) with a pressure on the upstream face of well over 10 times that arising from water. Similarly, shaking-table model tests showed the dam would be entirely safe with an acceleration equal to gravity, 10 times the usual allowance for dams in seismically-active regions. The dam and other components of the power development are not located in a seismically-active area.

Three of the world's leading consultants (Dr. Karl Terzaghi, Dr. J. P. Growdon, and Mr. I. C. Steele) were retained to consider the design. Arising from their advice, it can be concluded:—

1. The foundation is adequate as to strength and, when grouted as intended, satisfactorily water tight.
2. The dam will have a very large factor of safety.
3. The dam should require no maintenance.
4. The dam will have a life measured in geological rather than historical time.

Materials for construction of this dam will be drawn from closely adjacent quarries and borrow areas. Entirely suitable rock and impervious material, combined with thorough control, will add to the reliability and life. About 3,700,000 cu. yds. of fill will be used.

Unwatering of the site was effected by a diversion tunnel in the left-hand bank, completed during 1951. This tunnel, of horseshoe cross-section, about 1,430 ft. long, with a slope of 0.0135, is provided with closure means at the upstream portal and will eventually be plugged by a concrete plug below the impervious core and grouted zone. The rockfill cofferdam below the tunnel entrance portal and above the damsite proper has its crest at El. 2,590.

Discharge of surplus or flood waters will be effected at a location remote from the Kenney Dam, a most desirable feature. Spillage capacity of 30,000 c.f.s. will be incorporated in a simple free spillway at Skins Lake, with crest at El. 2,800. With the reservoir at flood level of 2,807, the 500 ft. long structure, with an effective length of 457 ft., will discharge the required 30,000 c.f.s. through the Cheslatta Lake basin to the Nechako River, some 5 miles below the Kenney Dam.

Low points in the flow line of the reservoir require the construction of six low and short rock or earthfill dykes, with sloping impervious core, from locally available materials.

For most efficient use of Tahtsa Lake water in a particularly dry season during the initial stage, a temporary rockfill embankment may be built at a location about 300 ft. below the outlet of Tahtsa Lake. A free spillway 250 ft. long will be incorporated. Although rock foundations are not available, no deep cutoff will be necessary. Suitable material is available within ½ mile of the site. Work here would be scheduled to follow completion of construction operations at the power tunnel portals and intake structure to a point at which Tahtsa Lake can be safely raised above El. 2,785.

In order that water can be drawn via the Tahtsa River from the Nechako reservoir to Tahtsa Lake and thence to the power tunnels, it may be necessary to excavate the 3 mile stretch of Tahtsa River immediately below the outlet of Tahtsa Lake to a depth of about 40 ft. Actual depth of cut will be governed by power requirements during the reservoir filling period.

Additional Storage Dams

The storage and diversion of the Nanika-Kidprice Lakes water will require a dam similar to Kenney Dam, about ½ mile below the outlet of Kidprice Lake. Good foundation rock exists but the porphyry and

A view of the Nechako Canyon damsite (Kenney Dam) in October 1951 after the diversion of the river through the diversion tunnel. The upstream portal of the tunnel is shown at left.

andesite formation will probably require somewhat more grouting than the Kenney Dam foundation. This dam will have a maximum height of about 155 ft. and a crest length of about 800 ft., the volume of all fill in place amounting to about 500,000 cu. yd. To handle flood waters from the Nanika-Kidprice diversion a low concrete free-crest spillway will be constructed at the westerly end of Des Lake, the discharge returning to the Nanika River several miles below the storage and diversion dam. Crest of the spillway will be at normal full reservoir level of 3,106.

To divert water from the Nanika-Kidprice watershed, it is planned to drive a free discharge tunnel uphill from the Tahtsa portal. The invert at the Nanika Lake inlet portal will be low enough to carry the maximum natural outflow with reservoir level maintained at the Des Lake spillway crest at El. 3,106. The tunnel will be about 3.8 miles in length, and have an equivalent diameter of 13 ft. No work on this part of the project is contemplated at this time.

Power Tunnels

There will be two unlined power tunnels, one of which is now under construction, with concrete paved inverts, each about 10.1 miles in length from the intake at the west end of Tahtsa Lake to the base of the surge chamber. These tunnels will pierce the Coast Range mountains on the right-hand side of Horetzky Creek (Fig. 4). The intake will consist of a concrete structure located about 1,000 ft. west of Penteuch Pass Creek. A short channel about 80 ft. wide at the invert will be excavated between Tahtsa Lake and the intake structure, which is being built in the dry.

The intake structure will be equipped with trash racks, guides for bulkheads and for two 14-ft. by 26 ft. fixed-wheel gates, each controlling the flow to one of the two power tunnels, the invert of which near the intake structure will be at El. 2,718. The gate sill for No. 1 tunnel will be at El. 2,275 in order to use Tahtsa Lake water only in the first stage; the other will be at El. 2,740. At the surge chamber, at the west end, the tunnel invert will be at about El. 2,591.

Geological advice indicates the rock at the intake end of the power tunnels, and for an undetermined distance west of the intake, consists of the older volcanic types such as porphyries and andesites. West of the contact the rock is classified as a quartz diorite which should drill and break advantageously.

In analyzing the overall economy of the power tunnels, the design was based on experience with tunnels in the U.S.A. from which a friction factor predicated on Kutter's $N = 0.040$ is found to check closely for unlined tunnels. In the case of those tunnel sections assumed completely lined, Kutter's $N = 0.014$ also agrees closely. In the analysis, the nominal sizes of the modified horseshoe cross-sections were fixed by evaluating the value of power loss due to friction head against construction cost, cost of money and operating cost.

The cases investigated were as follows:

1. Single 35 ft. diameter tunnel;
2. Twin 25-ft. diameter tunnels;
3. One 20-ft. diameter and one 30-ft. diameter tunnel;
4. One 19-ft. and one 30-ft. diameter tunnel.

The economic analysis resulted in the conclusion that twin 25-ft. diameter tunnels would be most economical, and possibly somewhat more reliable than a single 35-ft. diameter tunnel. Friction losses and tunnel costs were based on the use of steel supports and/or 18-in. concrete lining for 10 per cent of the total length, where required for support or to cut off influxes of water.

The No. 1 power tunnel will be the north tunnel of the ultimate twin 25-ft. diameter tunnels, spaced 300 ft. apart. Its invert will slope uniformly 0.0025 downward towards the surge shaft. The cross-section will have an area of about 527 sq. ft., with a volume of excavation per lineal foot of 19.5 cu. yd. With average overbreak, the volume of rock to be excavated per lineal foot of tunnel will be 23.0 cu. yd. Although each tunnel will normally carry 3,500 c.f.s., it is designed to take about 4,500 c.f.s. maximum.

The tunnel is to be driven from four headings. These will be: east from the surge shaft; both directions from a 1,600 ft. adit in the Horetzky Creek valley near the midpoint of the tunnel length; and west from the intake end. Concrete plugs and removable bulkheads will be installed in the west adit, and possibly in the Horetzky adit, for use in initial sluicing of the tunnel and for maintenance access during operation of the plant.

Tunnels vs. Penstocks

Up to the pressure conduits, including the related surge chambers, the pressure conduits themselves, the manifolds and the valve chamber, the Nechako-Kemano power development follows very closely North American high-head practice, aside from the capacity of the storage reservoir, the size of the

The Kenney Dam area showing the approach roads and the main quarry hill. Because of its location on a major headwater tributary of the Fraser River, a high degree of reliability is being built into this rockfill type dam.

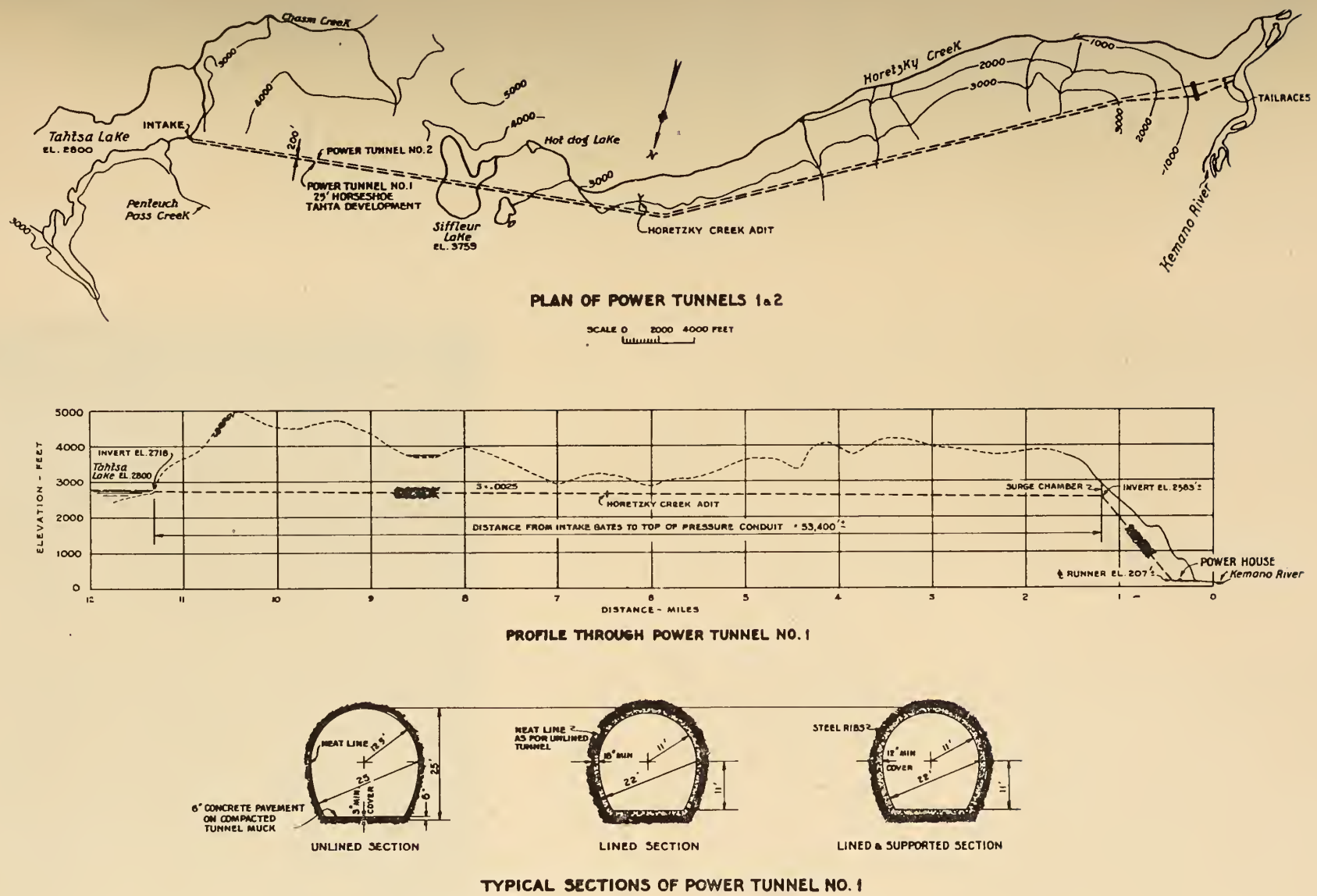


Fig. 4. Plan, profile and sections for power tunnel No. 1.

Kenney Dam, and the length and size of the power tunnels. Beyond this point, however, the component elements of the power development are unusual in North American practice, corresponding more closely to many large and modern hydro-electric plants in Switzerland, France, Norway, Brazil and elsewhere. The most striking characteristic is that the pressure conduits and the powerhouse proper are emplaced a considerable distance inside the mountain mass. There are many reasons for this, as follows:—

1. Exposed steel penstocks for high-head power developments involve a maximum amount of steel as the penstocks must be designed to safely withstand indefinitely the normal maximum pressure plus pressure surges arising from sudden rejection or pick-up of load.
2. With suitable rock cover, a considerable reduction in the tonnage of steel can be secured, as the pressure conduit or conduits replacing the exposed penstocks only require such a thickness of steel liner that the steel and the encasing grouted concrete-backfill and rock together can safely resist indefinitely the maximum stresses imposed in service.
3. Costly exposed penstocks can be replaced by a shorter pressure conduit or conduits, the discharge from the water-wheels being carried through free-flow (non-pressure) tail-race tunnels. Offsetting this are the costs of the tailrace tunnels, access tunnels to the underground power plant, power cables between generators and transformers on the surface or, if the transformers are located underground, between the transformers and outdoor switchyard.
4. Massive supports and anchorages are required for exposed penstocks, and rock conditions are not always uniformly suitable for foundations.
5. Exposed penstocks, especially those in high-head developments, are vulnerable to enemy air action. Pressure conduits deep inside the mountain mass are not.
6. Steep mountain slopes, heavily forested, present a fire hazard arising from normal inspection and maintenance activities.
7. Should a fire occur on the penstock slope, the burnt-over slope would become vulnerable to potentially dangerous snow and rock-slides.
8. No maintenance of underground pressure-conduit external surfaces is necessary, but it definitely is with exposed penstocks.
9. An underground powerhouse, deep inside the mountain mass, is free from enemy air action. More economic foundations for massive powerhouse equipment can be secured, since rock conditions at the foot of a deep slope rising from a valley floor deeply filled with fluvio-glacial deposits, or with heavy talus, necessitate costly foundation work.
10. The marked advances since World War II in underground excavation and construction technique, particularly in the use of tungsten-carbide-tipped drill steel and bits, have resulted in lower excavation costs.
11. Construction work on exposed penstocks on a steep mountain slope would be practically impossible during the winter season with a heavy treacherous snow cover, but it can be carried on throughout the year with underground pressure conduits. To a substantial extent work can be carried out on the power plant proper through severe winter conditions more expeditiously and more economically than with a surface plant.
12. The use of concrete in an underground power plant is minimized. Why substitute concrete for rock of better quality?
13. No structural maintenance is required with the underground power plant.
14. More equable working conditions are available with the underground power plant, a factor of some significance as far as personnel are concerned.

Looking at the drilling end of the large jumbo on the 2,600-foot level of the 10.1-mile tunnel above Kemano. This face of the jumbo is rigged for the column-and-arm mounting of twelve 3½-inch power-feed drifters.

The pressure-conduit system for the first half of the ultimate 16-unit installation at Kemano will consist of the following elements, from the outlet end of the 25-ft. diameter No. 1 power tunnel, proceeding downstream:

1. A surge chamber or shaft excavated in the rock;
2. A steel wye, branching into 11-ft.-diameter pressure conduits, each controlled by an 11-ft.-diameter oil-pressure-actuated butterfly valve located about 300 ft. below the wye;
3. Just downstream from the butterfly valve on each pressure conduit an air-inlet valve, to admit air into the pressure conduit whenever it is drained for inspection and maintenance;
4. An 11-ft.-diameter pressure conduit about 4,000 ft. long, serving four units;
5. At the lower end of the pressure conduit a manifold, symmetrically branched at 45°

offsets and tapered to four 5-ft.-diameter branch pipes, each serving one 140,000-hp. generating unit;

6. About 140 ft. downstream from the first or major wye in the manifold, spherical valves located in an underground valve chamber, drained to the tailrace. These valves will be approximately 140 ft. from the centre line of the units.

Conduit Design

One 11-ft.-diameter pressure conduit will serve four units, being controlled at its upper end by a surge chamber, to limit pressure rises to an acceptable value and permit rapid increase in flow, and a butterfly valve.

The basic design of the pressure conduit involves the use of a steel liner, which will serve as a watertight diaphragm, and as an inside form for the concrete backfill placed between the steel liner and the rock sheath. Under operating conditions, the hydrostatic pressure in the conduit will be carried partly by the steel and partly by the weight of the overlying rock. At the powerhouse and valve chamber openings, the steel carries the entire stress arising from the internal water pressure. The concrete backfill and rock encasing the steel liner will be thoroughly grouted at suitable pressures to fill all voids and seams in the encasement, and to consolidate the rock so that a thoroughly reliable and uniform structure is secured.

The shaft for the pressure conduit is being driven at an angle approximately 48° from the horizontal, through an adit at the powerhouse level to approximately El. 1,600, at which level an adit will permit raising the upper half of the shaft, also at an angle of approximately 48° from the horizontal. It is planned to provide a moderate offset in the pressure conduit at the mid-point adit to facilitate construction operations.

Including 1/16 in. allowance for corrosion, the steel liner in the pressure conduit will range from a thickness of 9/16 in. at the upper end to 1 5/16 in. at a point 150 ft. upstream from the first wye in the manifold. Just above the wye, the thickness will be 2 1/2 in. That section of 5 ft. internal diameter pipe immediately upstream from the turbine flange will be 2 3/4 in. plate. It is planned to use steel meeting A.S.T.M. specification A285, firebox quality, Grade B, semi-killed, for plate 1 in. thick and under. Thicker plate will be A.S.T.M.—A201, firebox quality, Grade A. This steel is being used because of the recognition that a steel with moderate tensile strength, high ductility, freedom from notch-impact weaknesses, and one which can be reliably welded, is of prime importance. All field joints will be radiographed, following continuous high-quality inspection.

Fig. 5. Plan of the aluminum-reduction plant (black rectangles to left of Kitimat River) and the townsite (above Minette Bay).

The spherical valves controlling flow to each turbine will be double-seated, with cast-steel bodies; the body seat rings will be moveable, and their operating controls so arranged that the upstream seals are normally disengaged. Designed to pass a maximum flow of 555 c.f.s., under normal operating conditions, the 51 in. diameter valves will be under a maximum velocity of 39.2 f.p.s. Maximum velocity in the 5-ft. branch pipes will be about 23.6 f.p.s.

Nothing has been left to chance in the design of the pressure conduit. In addition to thorough and independent reviews of outstanding high-head power developments employing pressure conduits in Switzerland, France, Norway and elsewhere, particularly as to design and construction, weaknesses which have shown up in such plants elsewhere have been carefully examined. In addition, Dr. Arnold Kaech of Switzerland, who has designed and constructed many large high-head developments, similar to Kemano, in Switzerland, France and Italy, was retained as a consultant.

The properties of the rock through which the pressure conduits pass was investigated by means of a 10 ft. diameter test sphere encased in rock and concrete, and subjected to a test pressure of 3,600 p.s.i., virtually three times the pressure to which the pressure conduit will be subjected. Analysis of the test results show that an average modulus of elasticity of the rock at 1,500,000 p.s.i. could be taken, corresponding closely to the value predicted in advance of the test. In addition, all phases of liner fabrication and jointing have been thoroughly investigated, special tests being run in many instances in

order to verify predictions based on general knowledge and experience.

Underground Power Plant

Factors influencing the decision to construct an underground power plant, deep inside the mountain mass, have already been stated. It may not be generally known that over 75 such plants have been or are being built, scattered all over the globe. Where the underground hydro-electric power plant meets the geologic and economic conditions, neither geography nor climate affect their use. Such plants have been built well above the Arctic Circle, examples being the Porjus and Harspranget developments in Sweden and Niva in Russia. Underground plants exist in Southern Italy, as at Flumendosa; Sulak in the Eastern Caucasus and Brommat in France. Underground power plants are under construction in Brazil, Peru, Australia and elsewhere.

Neither head, flow nor size limit development of water-power resources by means of underground power plants. Heads in existing plants range from a low of 17.7 ft. at Freidigen in Germany to a high of 3,540 ft. at Tyin in Norway. Design flow ranges from 15 c.f.s. at Foce Ponale in Italy to a maximum of 14,200 c.f.s. at Harspranget in Sweden. Underground hydro-electric power plants have been built in all types of geological formations comprising igneous, metamorphic and sedimentary rocks. Many of the underground plants, as in Sweden and Switzerland, are built in sound hard rock such as granite, requiring practically no support. Some, like Sulak, are in badly fissured and even somewhat disintegrated rocks, which require substantial and nearly continuous roof support.

Although not commonly known, the first underground power plant in the world was inspired by a Canadian plant at Niagara Falls. This plant, built in 1895, has its turbines in a pit, with vertical shafts extending up 140 ft. to the generators housed in a powerhouse on the surface.

The plant referred to is that at Snoqualmie Falls, Washington, where a 10,000 hp. plant was completed in 1898 to develop the hydraulic energy of the 270 ft. falls. Turbines, generators and control boards are located in a chamber 200 ft. long, 40 wide and 30 high, hewn out of solid basaltic rock. It is understood this plant has been in successful operation ever since. The Snoqualmie plant was placed underground to avoid excessive spray and ice conditions arising from its proximity to the falls. Experience has shown the plant to be clean, dry and well ventilated. The powerhouse chamber is unlined, the solid rock making this unnecessary.

Access to the powerhouse will normally be through an access tunnel with a length of about 1,400 ft. the upper portion of which will serve as an air duct. The access portion of the tunnel will be about 22 ft. in width and 14 ft. high. Emergency access or exit will be afforded in the upper portion of the tailrace tunnels, as well as the ventilation tunnel, which serves as a pilot access tunnel during construction.

A small village will be necessary at the power plant to accommodate operating and maintenance personnel. This will be constructed not far from the power station, where a suitable site is available in the Kemano Valley.

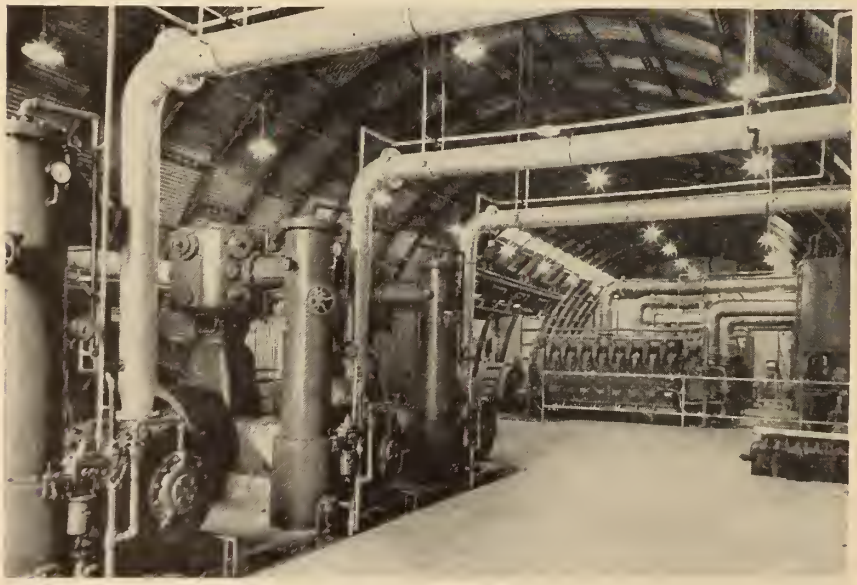
Equipment

The Kemano power plant, when completed, will have installed 16 vertical, single-runner, four-nozzle impulse turbines, each rated 140,000 to 150,000 hp. at 327 r.p.m. Space requirements, for the complete development, necessitate a chamber over 1,000 ft. long, 80 ft. wide and 135 ft. high. Each waterwheel will drive a direct-connected, vertical, three-phase, 60 cycle, 327 r.p.m., 13,800 volts, 0.8 power factor generator rated at 106,000 k.v.a. at 60 deg. C. rise and 122,000 k.v.a. at 80 deg. C. temperature rise with main and pilot exciters, with a short-circuit ratio of 1.0 and WR^2 in excess of 15,000,000. These generators will be able to carry 115 per cent. of the 60 deg. C. rating continuously.

Each group of two generators will feed into a double-primary bank of three single-phase, 71,000-89,000 k.v.a. transformers, rated at 300 kv. These transformers will be located in the power plant on the downstream side of the generators. Full provision for fire protection, drainage of oil from a ruptured transformer tank to the tailrace and adequate ventilation eliminate any hazard from such location of the transformers. Transformers have been installed underground in many plants, including the 380 kv. transformers at Harspranget.

The output of the transformers will be delivered to the switchyard at the surface, through 300 kv. oil-filled (60 p.s.i. oil pressure) power cables, 2,150 ft. to 2,260 ft. in length. These cables will be about 4 in. outside diameter, 515,000 CM, single copper conductor, paper insulated. The initial order for cable was split between two manufacturers, one of which will supply cable with an aluminum sheath.

Generator relay protection will consist of generator differential, split-phase differential using double-primary current transformers, and back-up relays comprising phase over-current and neutral. The transformer banks will be protected by ground differential and transformer differential relays embracing the outdoor high-tension breakers. The 600-volt station service will be pro-



A general view inside the Kemano construction power house. A total of 39,000 c.f.m. of compressed air is furnished by the portable and stationary compressors on the project. This is 50 per cent greater than the air power facilities at the Hoover Dam.

vided through 1,500 kva. transformers tapped from the generator 13.8 kv. leads. All control and relaying will be housed underground. The 300 kv. cables will be carried on open racks in two cable tunnels.

The design provides for the turbine runners being set with nozzle centre line at El. 210. One group of eight units will discharge to a tailrace tunnel 1,050 ft. in length and the other eight to a tailrace tunnel 1,100 ft. in length. At the downstream ends of the tailrace tunnels, with invert at El. 174, open-cut channels will complete the tailraces, discharging to the Kemano River.

Power Transmission

The terminal switching facilities at Kemano will be located in an outdoor switching station. Incoming feeds will consist of eight 300-kv., oil-filled cable circuits, each carrying the output of two generating units. Each incoming circuit will feed through a 300-kv. air-blast circuit-breaker, with a rupturing capacity of 6,000,000 kva. symmetrical, and thence to either one of two 300-kv. busses, through motor-operated selector disconnect switches. There will be four outgoing circuits.

From the power plant the first nine miles of the transmission system will comprise two double-circuit tower lines, gradually climbing to about El. 1,000, at which point these feed into a switching station with motor-operated selector disconnect switches. The outgoing lines will consist of two single-circuit transmission lines, running up to a maximum altitude of about 5,300 ft. in a distance of 10.6 miles. Here another switching station will be located, at El. 500, from which two double-circuit tower lines will run the remaining distance to the terminal station at the Kitimat aluminum-reduction plant. In this stretch of the line about 5 miles will run between El. 2,000 and 3,000.

Designing for the transmission of 1,670,000 hp. firm delivery at Kitimat through relatively narrow valleys, raked by snow and rockslides at some points, and across a narrow mountain pass with a maximum altitude of some 5,300 ft., is a difficult problem. The snow may lie 20 ft. or more deep during the winter months, and icing conditions may be very severe, with a short construction season. Moreover, the transmission lines must provide absolutely reliable service, because the aluminum-reduction process is a continuous one, and an interruption of power for more than a few hours would entail a costly loss of metal production.

Early in the investigations it was recognized that the Kemano and Kildala River sections of the transmission-line route did not provide much more than sufficient space for two double-circuit transmission lines. The 10.6 mile stretch through the Kildala Pass at elevations up to 5,300 only provides space for two tower lines, due to the extremely rough terrain. This section also was recognized as being difficult of access and undoubtedly subject to heavy icing conditions. This is due to the orographic influences on the warm moisture-laden winds from the Pacific, and the influence of snowfields and glaciers, the snouts of some of which approach the route rather closely. It was obvious that very rugged construction of the transmission circuits through the Kildala Pass would be necessary.

Because the country through which the transmission lines will pass is uninhabited and its weather unrecorded, in the fall of 1950 a test span of 795,000 CM ACSR was erected between two 26 ft. high aluminum towers, at an elevation of 5,300 ft. on the summit of Kildala Pass, some 2,000 ft. above the timber line. A crew of observers was stationed in cabins along the transmission route and the site of the test span was provided with recording instruments. During the winter of 1950-51 the maximum ice loading observed as 2.4 lb. per lineal foot. Obviously, conditions occurring during one winter are not necessarily the most severe which can arise.

Extensive investigation of icing on transmission lines in mountainous territory in Switzerland, Italy, France, Norway and Sweden was also carried out. Results of investigations made in these countries at experimental installations for icing observations were studied. One of these was the experimental station installed on the summit of the Puy de Dome in south-central France, at an altitude of 4,806 ft. Here the rainfall is fairly heavy, high winds are experienced, and in winter the formation of glaze and rime loads is severe; probably worse than encountered in any other mountainous area in France. At this station, a maximum ice load of about 27 lb. per ft. has been experienced.

Lightning hazards are of sufficiently low frequency over the route traversed by the transmission lines, that no ground wires are being provided except for one mile at each terminal.

Transmission Line Design

For the double-circuit tower lines, standard ACSR 54/19 (Falcon), 1,590,000 CM cross-section, with an outside diameter of 1.545 in. and a weight of 2.032 lb. per ft. is being used. Ultimate strength of this conductor is 55,400 lb. The double ground wire at the terminals will be ¾ in. diameter HS steel cable, with an ultimate strength of 50,000 lb. Insulation will comprise a minimum of 15 and a maximum of 18 units per string, 10 in. by 5¾ in., 25,000 lb. M and E standard suspension units. Single strings will be used for suspension points, with double strings for long spans. At strain points triple strings will be used.

The basic conditions determining loads and load combinations for design of the double-circuit towers are as follows:

A. Ice load at 24 lb. per ft. of conductor length at 0 deg. F., as a yield point load.
B. 2.0 in. radial ice deposit on the conductor.
C. 2.0 in. radial deposit of rime on the conductor combined with wind at 8 p.s.f.
D. ¾ in. radial deposit of ice combined with wind at 11 p.s.f. and broken conductor action.

The A loading is used for determination of the yield point stresses, whereas the others are used for computation of stresses under normal working loads.

The specific gravity of ice is taken at 0.90 and of rime at 0.30, in the specified cases. The wind pressure on flat tower members, considering the members coated with 1 in. ice, is being taken at 1.6 times the wind pressure on the conductor. The loads at conductor support points resulting from the above conditions, plus the dead load of the conductor and the hardware, together with the extreme limits of tower application as to line angle, span and slope, are being used as the basis for tower design.

To account for the effect of being buried in snow (which may reach considerable depths), both as to weight and creep, all members of the tower structure below the specified height from the ground line are considered as subjected to the following loads:—

1. Towers located at or above El. 3,200:
   (a) Vertical load equal to (3,000-100 h.) lb. per ft. of horizontal projection of member length (h is feet above ground line);
   (b) Horizontal load of 300 lb.

per ft. of member length acting in any direction.

These loads are applied to all members below 19 ft. above the ground line.

2. Towers located between El. 1,000 and El. 3,200:
   (a) Vertical load equal to (1,000-400 h) lb. per ft. of horizontal projection of member length (h is feet above ground line);
   (b) Horizontal load of 100 lb. per ft. of member length acting in any direction.

These loads are applied to all members below 13 ft. above ground line.

The values of loads (a) and (b) are independent of member cross section and their effects are each considered separately and independently of the effects of conductor loads. The towers are being designed to accommodate leg extensions within a range of 0 ft. to plus 24 ft. in 4 ft. sections.

Depending on tower location and ground conditions, various types of footings will be used as follows: (a) Steel grillage on earth, gravel, broken or rotten rock; (b) Rock anchor, on sound, solid rock; and (c) Concrete pedestal, for special conditions.

For the single-circuit tower lines through Kildala Pass, the conductor will be ACSR, with an outside diameter of 2.295 in., a weight of 4.77 lb. per ft. and an ultimate strength of 135,700 lb., the cross-sectional area being 3,364,000 CM. The same type of insulators as used on the double-circuit tower lines will be utilized, except there will be a minimum of 18 and a maximum of 21 units. Quadruple strings will be used for suspension, and sextuple strings for strain applications. A maximum insulator swing of 36° from the vertical is allowed.

Basic conditions determining load and load combinations for the towers have been taken as follows:

A. Ice load of 40 lb. per ft. of conductor length at 0 deg. F., as a yield point load.
B. 2.5 in. radial ice deposit on the conductor.
C. 2.0 in. radial deposit of rime on the conductor combined with wind of 8 p.s.f.
D. ¾ in. radial deposit of ice combined with broken conductor action.

Other design considerations are the same as for the double-circuit towers, except that under some conditions a wind load at 120 m.p.h. is assumed acting on the tower surfaces.

One of the two single-circuit transmission lines across Kildala Pass will be built with steel towers, of generally conventional design. The suspension—light angle towers will weigh about 33 tons each; the heavy angle-strain type will be substantially heavier, depending on height. The other single-circuit transmission line across Kildala Pass will be built with aluminum towers, using a design of which a prototype has been successfully built and thoroughly tested. This design is a braced H-frame type tower with five thin-walled aluminum tubes about 38 in. in diameter and a box-girder crossarm. These towers will weigh about 10 tons each. They are expected to show substantial economies in transportation, erection and maintenance.

Because the electrical loading of the transmission system as outlined, at 1,670,000 hp. firm delivery at Kitimat, represents a far heavier load than has hitherto been transmitted 50 miles over a transmission system as outlined, and because the reliability of service must be high, the whole system was set up on a network analyzer, taking into account the necessary characteristics of the generating equipment, the step-up and step-down transformers, the transmission circuits and the mercury-arc power-conversion equipment at the load. This investigation revealed that the transmission of 1,235,000 kw. at 92 per cent power factor over one-half of the transmission system would require about 400,000 kvar. of condenser capacity, or 33,000 kvar. per load step-down transformer bank, as contrasted with a normal maximum requirement of about 15,000 kvar. per bank. Maximum voltage required at the generating-station terminal will be 302 kv.

At the aluminum-reduction plant, the terminal station will be somewhat similar in arrangement to that at the generating station, except that there will be ultimately 12 step-down transformer banks, normally each supplying a single pot-room with bussing facilities to permit transfer of power to other loads, a bank for miscellaneous load and a spare bank. It is visualized there may be synchronous condensers, but most of the corrective capacity will be in the form of static capacitors on the low-tension side of the step-down banks.

Aluminum-Reduction Plant

The reduction plant, or smelter, is being built partly on the delta of the Kitimat River, and partly on alluvial fans that have been deposited on the edge of the delta by two creeks which discharge from the mountain slopes to the west. Fig. 5 is a general plan of the area. The Kitimat River is a relatively short water course, and the delta materials are coarser than usual, varying from silty sand to small gravel.

The alluvial fans are gravel and coarse sand. Foundation conditions are fairly good, but the whole area is low, running from slightly below high tide up to 30 feet above high tide, and the water table is high. The buildings are therefore being built on a compacted gravel fill, up to 30 feet high at the lowest part of the site. Ample quantities of sandy gravel are available, but a haul of about two to three miles is required.

The harbour works are in the tidal region of the delta. A dredge cut will be excavated through the tidal flats, and a wharf consisting of large concrete boxes floated into place, then sunk and filled with gravel, will be built at the edge of the cut. Two rock moles have been built to contain the dredged material, in an area between the wharf and the smelter. This hydraulic fill will be used for storage space, and for some relatively light buildings; owing to its low bearing capacity, no important buildings will be built on it during the early years.

Cargo handling equipment is now being developed to handle bulk alumina (aluminum oxide), as well as other bulk materials, and aluminum ingot. Owing to the abrasive qualities of alumina, and to the tidal range of over 20 feet, careful attention is being given the design of bulk unloading towers.

Townsite

Not the least of the many problems is the development of a townsite intended ultimately to house 50,000 people. Planning and engineering for the townsite in such a remote area, with no initial facilities, has required the service of a number of specialists, all of whom feel that, in spite of difficulties due to climate, sloping ground, gullies and heavy timber cover, there is an unique opportunity at Kitimat to produce a community free from the inherited mistakes and congestion that cause so much expense in other places.

The townsite is across the Kitimat River and four miles up the valley from the smelter; there will be high initial costs for roads and bridges to connect the two. A railroad is also planned by the Canadian National

Railways, to connect with their Prince Rupert branch at Terrace, 40 miles north of Kitimat, and a highway may be built along a parallel route.

Salient Facts on Nechako-Kemano Development

Among the outstanding features of the Nechako-Kemano hydro-electric development are:

1. When completed, it will be the largest underground power development in the world, having a firm capacity over three times the ultimate installed capacity for Sweden's Harspranget development and about 1.7 times that for Brazil's combined Forcacava No. 1 and No. 2 plants.
2. When completed, it will have an installed capacity substantially in excess of Boulder (Hoover) Dam and be exceeded only by the now-completed Grand Coulee development of 2,250,000 kw.
3. When completed, it will have an annual firm energy generation well in excess of the estimated 8,100,000,000 kwh. firm from Grand Coulee.
4. The Kenney Dam across the Nechako Canyon will be the third highest rockfill dam in the world.
5. The Nechako storage reservoir will have a capacity only exceeded by Boulder Dam's Lake Mead and by Fort Peck Dam. It will be twice that of Grand Coulee.
6. The vertical turbines will be the world's greatest capacity impulse type units.
7. The 2,600 ft. head, 11 ft. diameter pressure conduit is, so far as known, not exceeded by any other built or under construction today.
8. The 300-kv. oil-filled power cables will constitute the highest voltage power cables in service in North America and the second highest in the world, only exceeded by the 380-kv. cables at Harspranget in Sweden, which are presently operated at 230 kv.
9. The transmission-system loading will be the world's highest, by a substantial margin; the conductors will be the largest ever fabricated.
10. The Kitimat reduction works will be the world's largest aluminum smelter.

Acknowledgments

The Nechako-Kemano power development, the transmission system, the Kitimat aluminum-reduction plant and the townsite facilities and housing are being built by Alcan, the Canadian production subsidiary of Aluminium Limited. The whole development is a tribute to the vision and work of Mr. McNeely DuBose, M.E.I.C., vice-president of Alcan. Mr. A. W. Whitaker, Jr., M.E.I.C., is vice-president and general manager; Mr. W. L. Pugh, M.E.I.C., is chief engineer; Mr. P. E. Radley, M.E.I.C., is project manager.

Engineers for Alcan on the power development and transmission facilities are British Columbia International Engineering Company Limited (a subsidiary of International Engineering Company, Inc., of San Francisco), of which Mr. W. G. Huber is general manager. The contractor in charge of construction of the power development and transmission system for Alcan is Morrison-Knudsen Company of Canada, Ltd. (a subsidiary of the parent Morrison-Knudsen Company, Inc.), of which Mr. C. P. Dunn is vice-president and general manager. Facilities at Kitimat are being built for Alcan by Kitimat Constructors, a joint-venture group of eight Vancouver contractors.

In connection with the town facilities at Kitimat, Mr. Clarence S. Stein, of New York, a world-recognized authority on town planning, is Alcan's professional representative co-ordinating and guiding the work of the consultant team. The firm of Mayer and Whittlesey of New York has been retained as the consultant for the townsite and general master plan. Townsite engineering is being carried out by Swan, Rhodes and Wooster, of Vancouver.

Consultants retained in connection with the power development include:-

On the Kenney Dam—Dr. Karl Terzaghi, Dr. J. P. Growdon and Mr. I. C. Steele; Dean R. M. Hardy of the University of Alberta on detailed control of the impervious core construction. On geological investigations—Dr. Victor Dolmage and Dr. Alfred Falconnier (of Switzerland), the latter on geological structure of the pressure conduit and powerhouse sites. On the design of the pressure conduit and underground powerhouse, and related aspects, Dr. Arnold Kaech, of Switzerland.

F. L. Lawton is chief engineer, Power Department, Aluminium Laboratories Limited, a development, investigation and research organization, which is a subsidiary of Aluminium Limited. He was closely associated with the initial investigations and is currently acting in a consulting capacity on a number of major engineering problems, such as the pressure conduits, underground powerhouse, transmission facilities and system planning. J. S. Kendrick is assistant manager, Project British Columbia, for Alcan, and has been intimately connected with the development since the initial investigation. √

A tower of the aerial tramway at the 2,600-foot level. The tramway runs from the camp at Kemano to the upper portals to the penstock and main tunnel excavations.

Trans Mountain Oil Pipeline

S. M. Blair *and* D. L. Roberts

Vice-President,
Trans Mountain Oil Pipe Line Company,
Toronto.

Vice-President,
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Vancouver, B.C.

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

Recording the growth in Canadian oil discovery, production and refining, the author assesses oil reserves and traces the growth of pipeline facilities to transport it. Showing how much of the production can be made available to Pacific Coast markets up to 1955, he describes the methods used in locating and designing the trans mountain pipeline and the procedure to be followed in building it.

Growth of the Canadian Oil Industry

The first Centenary of the world oil industry might well be held in Canada, since production from oil wells was actually carried out near Petrolia, Ontario, in the mid-fifties of last century.

Early petroleum production in Ontario from shallow wells of only a few hundred feet in depth was amazingly prolific. Unfortunately the field was practically exhausted before the industry had learned either the technique of handling an oil field, or of refining the oil. During the hundred years since the first discovery, two phases of our oil industry, refining and marketing, have progressed steadily within the country. But it has only been in the last decade that the other two phases, production and transportation, have become major developments.

While the search for Canadian crude oil was going through the trying experience for several decades of only being rewarded with dry holes, the industry as a whole, backed by the development of other Canadian natural resources, was growing rapidly in all-round economic strength. There was a steady increase of oil refining, with the result that by 1920 there were ten refineries in Canada using approximately 8½ million barrels of oil annually, nearly 98 per cent of which was imported. At the beginning of the last war, in 1939, there were 38 refineries processing a total of about 50 million barrels of oil a year, of which 17 per cent was from Canadian fields. The supply of crude to refineries, and the movement of products therefrom ten years ago, was all carried out by water shipment or by rail and road transport.

The price of "coal oil" in 1860 according to advertisements in the Ontario papers of that time, was from 70c. to $1.00 per imperial gallon. That price, three or four times the cost of the corresponding oil today, will be seen to be a remarkable achievement when recognizing the inflation that has taken place during the century, and the greatly increased shipping distances that are now encountered, the greater depth from which production is carried out, and the higher quality of product now made.

With the rapidly increasing consumption of oil per capita in this country (British Columbia consumption of gasoline is now 600 gallons per annum per capita), the necessity of Canada having both a major supply of her own crude oil, and of having cheap transport, is obvious if the public and the industries are to obtain essential liquid fuels at competitive world prices.

D. L. Roberts (left), co-author of this paper, is shown at the annual meeting with R. L. Dunsmore, M.E.I.C., who chaired the session at which the paper was presented.

Control of the Oil Resources

The Dominion Government transferred the mineral rights on all Crown lands, with the exception of National Parks and Indian Reserves, to the Provinces in 1930. Today this nation's potential crude oil production from Alberta alone is almost equal to one-half of Canada's requirements. Since over ninety-five per cent of production comes from Alberta, that province has

Table I—Principal Western Canada Crude Oils

INSPECTION DATA

	Leduc	*Red-water*	*Stettler*	*Turner Valley*	*Big Valley*	*Flint*	*Golden Spike*	*Lloyd-minster*
Gravity	39.2	34.9	27.7	42.7	33.2	35.9	35.3	14.5
Sulphur %	.34	.48	1.55	.39	.99	.94	.23	3.14
Pour °F	25/20	−50	5	−30	plus 30	−15	0/−5	15/10
B. Sand Water %	.20	Trace	1.6	.50	1.0	.5	.5	1.6
I.B.P. °F	132	111	119	98	120	120	118	207
% @ 400	40	35	27	47	30	36	36	8.0

taken the lead in developing oil legislation and policies for the industry. Their regulations have a most direct bearing on Canadian oil developments in general at the present time.

The Province regulations are now relatively well known, but it is pertinent also to note something of the area and ownership of resources in the province. Mineral rights in Alberta are under the following ownership: Dominion Parks and Indian Reserves, 14.7 million acres; Railways, Hudson's Bay Co., and other freehold, 16 million acres; Alberta Province, 132.6 million acres; or a total of 163.4 million acres. The privately owned lands that possess their underlying minerals thus amount to about ten per cent of this total, while the Dominion's holdings are also about 10 per cent. The province itself owns the remaining 80 per cent of the mineral privileges. In general, settlers purchasing land from either the Hudson's Bay Company or the railway companies, received title to both the surface and mineral privileges up until 1908. The mineral rights of the Crown lands have not been generally granted to the purchasers of homesteads since 1887.

Development of the Turner Valley field permitted oil legislation and controls to be developed, put into practice and tested before the present large fields were found. Thus when the Leduc discovery was made in 1947, it was possible for orderly and efficient controls to be applied from the inception. This contrasts with the chaotic conditions found in many of the world's other large oil producing areas when their production was first started.

The oils vary in quality, from the Turner Valley production with almost fifty per cent gasoline volatility, to the heavy asphaltic oils occurring at Lloydminster on the Alberta-Saskatchewan boundary. Physical properties and sulphur contents are shown in Table I.

Transportation Facilities

Present developments indicate that during the decade between 1947 and 1957, Canada's crude production will go from a negligible amount at the outset, to a production equivalent to the greater part of the total requirements. The magnitude of that accomplishment is further seen by noting that even at present it means satisfying an industry using one million dollar's worth of raw material per day. The effect on the nation's economy can be readily appreciated.

The confidence of the industry in its ability to maintain and increase its rate of production, has also led to unprecedented developments in the country's oil transportation system. In 1950, the only crude oil pipeline system in Canada of any consequence was a portion of the Portland-Montreal line. Within a period of four years from that time there will be a major pipeline and tanker system extending from Montreal to Vancouver. This will be made up of the Trans Northern Pipe Line Company's 440-mile 10-in. products pipeline from Montreal to Toronto; the 12-in. Imperial Pipe Line Company's products pipeline from Sarnia to Hamilton and the continuing 10-in. line to Toronto (a total distance of about 180 miles); the 1,100-mile Interprovincial 20-in. and 18-in. crude oil line from Edmonton to the Great Lakes, and the 720-mile 24-in. Trans Mountain Oil Pipeline from Edmonton to Vancouver.

These lines represent a major transport system that has all been conceived, financed, built and put into operation within a period of four years. As a transport system, the Trans Mountain line alone when in full operation and handling some 20 million ton miles per day, will represent a major freight movement. The great distances across Canada could readily have led to shipping costs for oil being excessive. Transportation costs are indeed the great economic hurdle faced by other heavy industries and resources. The oil and gas industries are extremely fortunate that through the use of

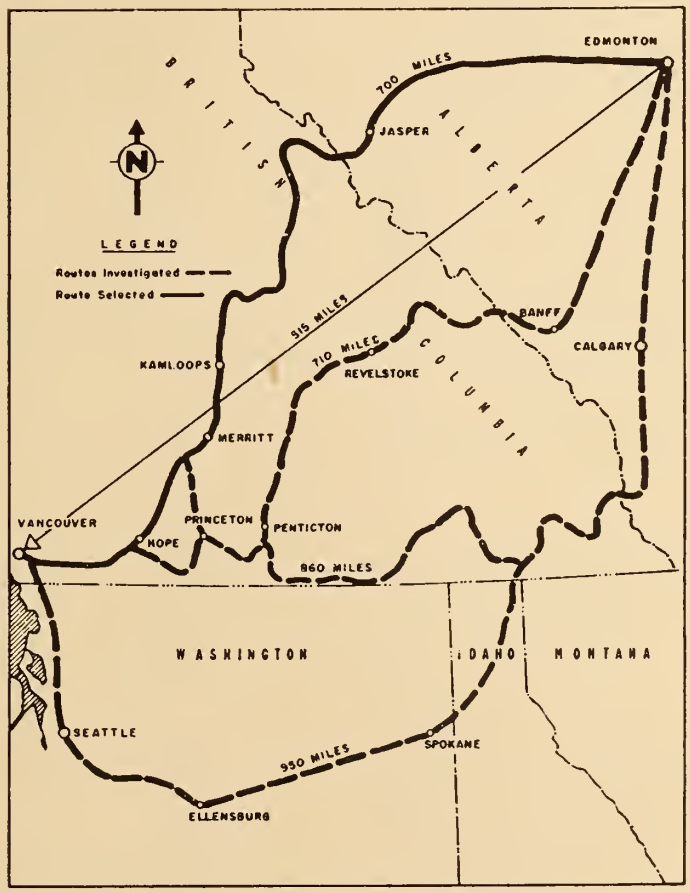

Fig. 1. The route of the 700-mile Trans Mountain Pipeline from Edmonton to Vancouver and other routes that were investigated.

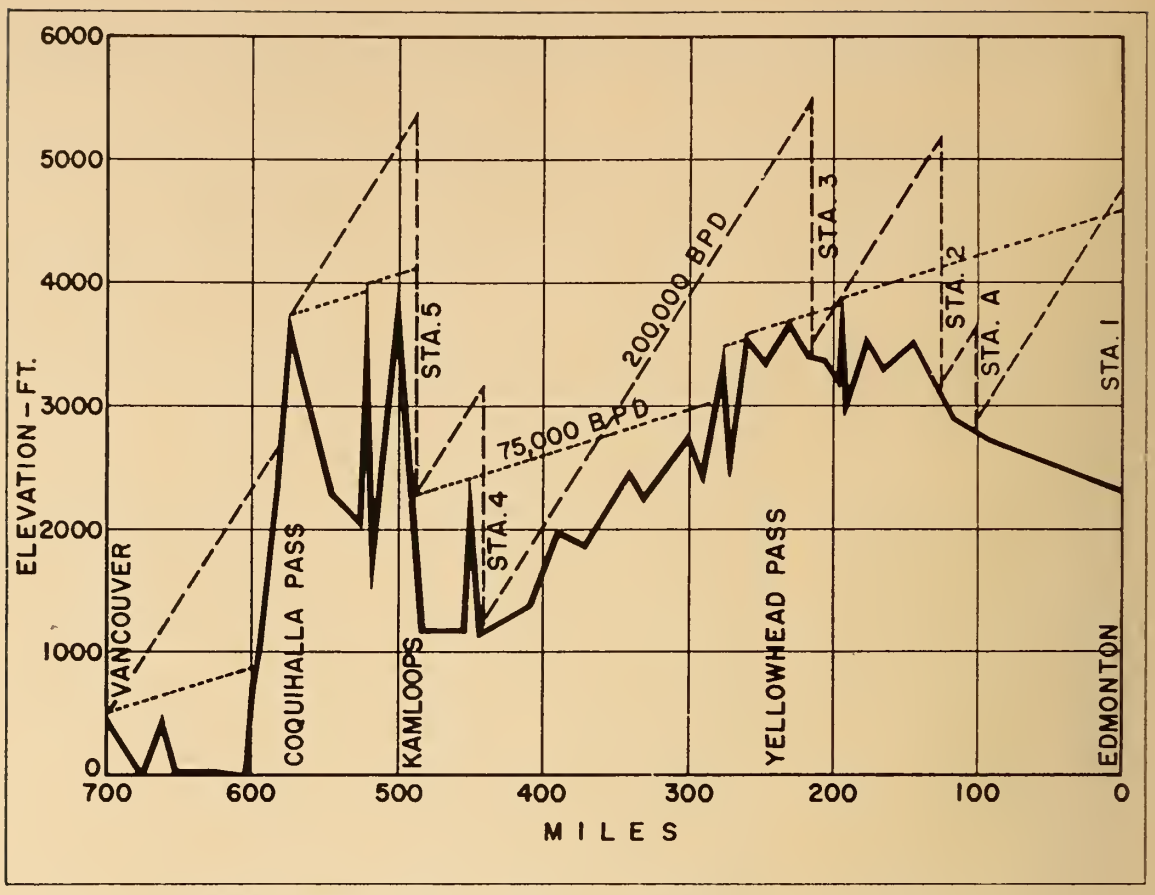

Fig. 2. The approximate profile of the Trans Mountain Oil Pipeline.

pipelines their materials can be transported overland at costs comparable with those that would result from ocean shipping.

The overall pattern followed in Alberta production is to first satisfy the Prairie markets from Western refineries. This requires nearly 100,000 barrels per day. The excess crude production will then be taken by pipeline either east to a terminal on the Great Lakes, or west to the Pacific Seaboard at Vancouver. The westward flow through the new Trans Mountain Oil Pipe Line will be to the refineries at Vancouver, where products can be made for the British Columbia market or shipped off-shore.

Output Available For Pacific Coast

When the feasibility of building the Trans Mountain Oil Pipe Line was under consideration, a careful study was made of the Alberta reserves.* The estimated oil in place as of October 1st, 1951, was 3,272,000,000 barrels, of which 1,330,000,000 barrels were considered recoverable. At the same time, recoverable reserves estimated for the end of 1953 were 1,866,000,000 barrels. When maximum efficient rates of annual production of 6 to 8 per cent are applied to those reserves, possible production in barrels per day at 7 per cent maximum efficient recovery is; for October 1951, 255,000 barrels; for October 1954, 358,000 barrels; and for 1955, 390,000 barrels.

Starting with the above amounts and deducting first the requirements of the prairie provinces and then the capacity of the eastbound pipeline, the amounts of oil available for the Trans Mountain Oil Pipe Line were as shown in Table II.

Location of the Pipeline

There are three conditions requisite to the location of an economical pipeline; (1) It shall follow the shortest practicable route from field to refinery; (2) It shall avoid extreme differences in elevation; and (3) The route shall be accessible both for construction of the line and its continued maintenance throughput operation.

Trans Mountain pipeline engineers have been able to meet these conditions to a surprising degree, considering the topography between the oil fields in Alberta and the refineries in Vancouver. The main oil producing region centers on the open plains around Edmonton. Some 200 miles to the west, the Rocky Mountains raise a formidable barrier. Still further westward the Coast Range, which is even more precipitous, provides so few traversable passes that railroads, highways, communication lines and power lines have largely preempted them to the exclusion of other forms of transportation.

The first step in selecting a route was to examine topographical maps of a wide strip between Edmonton and the Pacific, with particular

*Study carried out by Dr. A. I. Levorsen with the Stanford Research Institute.

Table II—Estimated Daily Production by Years Available for Various Markets

	Barrels per Day		
	1951	*1954*	*1955*
Producible crude oil supply as of October @ 7%	255,000	358,000	390,000
Prairie Provinces' requirements	86,000	96,000	100,000
Eastbound pipeline requirements for Great Lakes area (daily average)	39,000	92,000	92,000
Available for Trans Mountain Oil Pipe Line	130,000	170,000	198,000

attention given to the known passes. Figure 1 shows the various routes considered. Thus it was found possible to narrow the selection to only two routes: one through Crows Nest Pass to Spokane, Seattle and Vancouver, and the other over Yellowhead Pass directly to Vancouver.

The next step consisted of a reconnaissance over these two routes by airplane, automobile and train in January 1951. From the data collected, a comparative estimate of construction and operating costs was prepared. This indicated clearly that the all-Canadian route was more economical, not only in cost but in the tonnage of steel required. This is the route finally selected and, with minor variations, is where the pipeline will be built. (Fig. 1).

The route is not only the shortest practicable distance between Edmonton and Vancouver. It also meets the conditions of elevation and accessibility. One peculiarity of the passes through the Rocky Mountains is that they decrease in altitude towards the north. The Yellowhead Pass is only at elevation 3,720, just 1,400 feet above Edmonton. The western slopes drop gradually to elevation 1,200 and then the route rises abruptly to elevation 4,000 on the plateau south of Kamloops, B.C. The crossing of the Coast Range at Coquihalla Pass is only at elevation 3,660.

Fig. 2 shows the approximate profile of the line. For the first 500 miles west of Edmonton the route parallels the Canadian National to Kamloops. It then goes across country for 55 miles to Merritt, where it meets a line of the Canadian Pacific, and follows that line for 67 miles to the upper end of the Fraser River Valley. The last 80 miles into Vancouver traverses a settled community with highways and secondary roads.

In June of this past year the final phase of location began. Aerial photographs were taken of the entire route. These pictures, at a scale of approximately 3,700 feet per inch, showed a strip of country 5 miles wide. Experienced technicians studied the pictures under stereoscope, and plotted a location which was verified or altered in the field by six parties of engineers and construction men who walked the entire line, flagging the route. Survey parties followed, staking the line and making the necessary land ties. To date almost 400 miles have been surveyed. Heavy snowfall and subzero weather throughout the interior of British Columbia hampered, and at times temporarily stopped the work, but 5 parties persevered throughout the winter to prepare for construction this spring.

A pipeline is extremely flexible compared to a railroad or highway. It can go over obstacles without regard to grade, or wind around them in curves as sharp as 25 pipe diameters.* The one situation a pipeline locator will try to avoid is sidehill location and for two good reasons: first, the pipeline is not in a stable position as it would be at either the top or bottom of the slope or even coming directly down the slope, and second, because the construction of a pipeline requires a minimum of 30-foot wide roadway and in sidehill cut this can become very expensive. Within this rather broad range of limitations, the locator seeks primarily to assure that the line will be laid in stable ground and in a safe location. His secondary consideration is that the location will allow the utmost utilization of construction equipment to produce low unit costs.

*A scraper or "pig" is passed through the line at intervals during operation to clear the walls of wax deposit. The minimum curvature is set to allow free passage of the pig.

Across the rolling prairie and foothills for 200 miles west of Edmonton and in the 80 miles east of Vancouver, the location presents only the ordinary problems of swamp crossings and construction through congested areas. The geological features of the route through more than 400 miles of mountainous topography in the central section indicate heavy glaciation which has resulted in flat, relatively wide valleys whose beds are mainly silt interspersed with boulders. The reconnaissance notes revealed less than 15 miles of solid rock exposed along the route. At infrequent

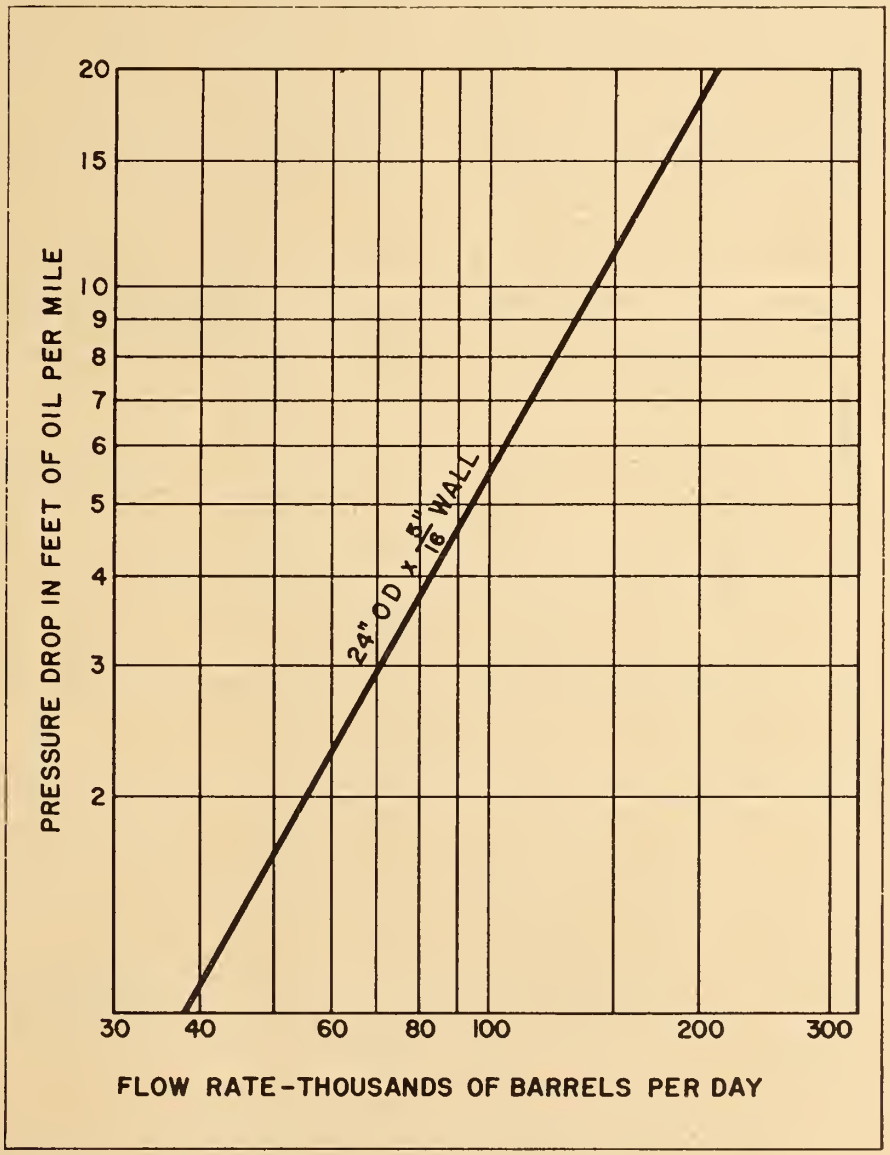

Fig. 3. The friction loss plotted for 24-inch pipe.

intervals there are side encroachments of bedrock, cliffs and slopes, rarely exceeding one-half mile.

Most of the problems of location occur in these constructed sections, and then only because a river, a railroad and the side of a future highway have usurped the valley floor. Generally the solution has been to accept some difficult construction and infringe on the railroad or highway right-of-way only when absolutely necessary, in a way mutually satisfactory to the pipeline company and the right-of-way owners. It has been possible to avoid most snow slide areas by crossing to the opposite side of the valley, or by placing the pipeline in the bottom of the valley where the only effect of a slide is to pile more cover over the line.

Pipeline Design

The physical characteristics of Redwater crude were assumed as typical for design of the line. This is a 35° gravity crude with a viscosity of 115 SSU at 40° F. The average temperature of oil flowing through the line was assumed at 40°F. Theoretical friction losses calculated on these assumptions were later checked against actual experience factors derived from the first 6 months operation of Interprovincial pipeline, and found to be conservative. The Fanning equation was used for computing friction loss. The value of f in the equation was taken from charts compiled by Bechtel Corporation from actual experience records on large diameter pipelines. Fig. 3 shows the friction loss plotted for 24-inch pipe.

Hydraulic gradients were then imposed on the pipeline profile to determine the number of pumping stations required. The first assumptions made in the study were that the stations would be balanced, i.e. the outgoing pressure at all stations would be approximately equal, and that a maximum pipe wall thickness of ⅜ in. would be used. Under this plan, two stations were adequate to deliver an initial throughput of 75,000 b.p.d., and five stations could deliver the ultimate throughput of 200,000 b.p.d. Later the stations were adjusted to take advantage of local differences in elevation and effect a reduction in pipe wall thickness. The present design still requires only two stations initially, but will have five main stations and a booster (Fig. 2), for the ultimate throughput.

The line is tapered by reducing pipe wall thickness in 1/32 inch increments as pressures decrease away from the stations. Five sixteenths inch pipe wall thickness has been set as minimum in the mountains and ¼ inch on the prairies. At two locations on the line, special pressure limiting stations are being designed to control the static head pressure resulting from shutdown of the line. One will be an automatic shut-off valve actuated by an increase in line pressure. The other will be a battery of relief valves draining the line into a storage tank.

High-test line pipe is specified for the job. This is an electric fusion welded pipe manufactured from steel made by the open hearth method and to API Specifications 5L x 52. It has a high manganese content:

.30% ..... Maximum carbon.
.75% to 125% Manganese
.045% ..... Maximum phosphorus
.05% ..... Maximum sulphur

It has been found necessary to limit the upper value of transverse yield strength to 75,000 p.s.i. Otherwise special and costly welding techniques are required in the field. The pipe is fabricated at less than

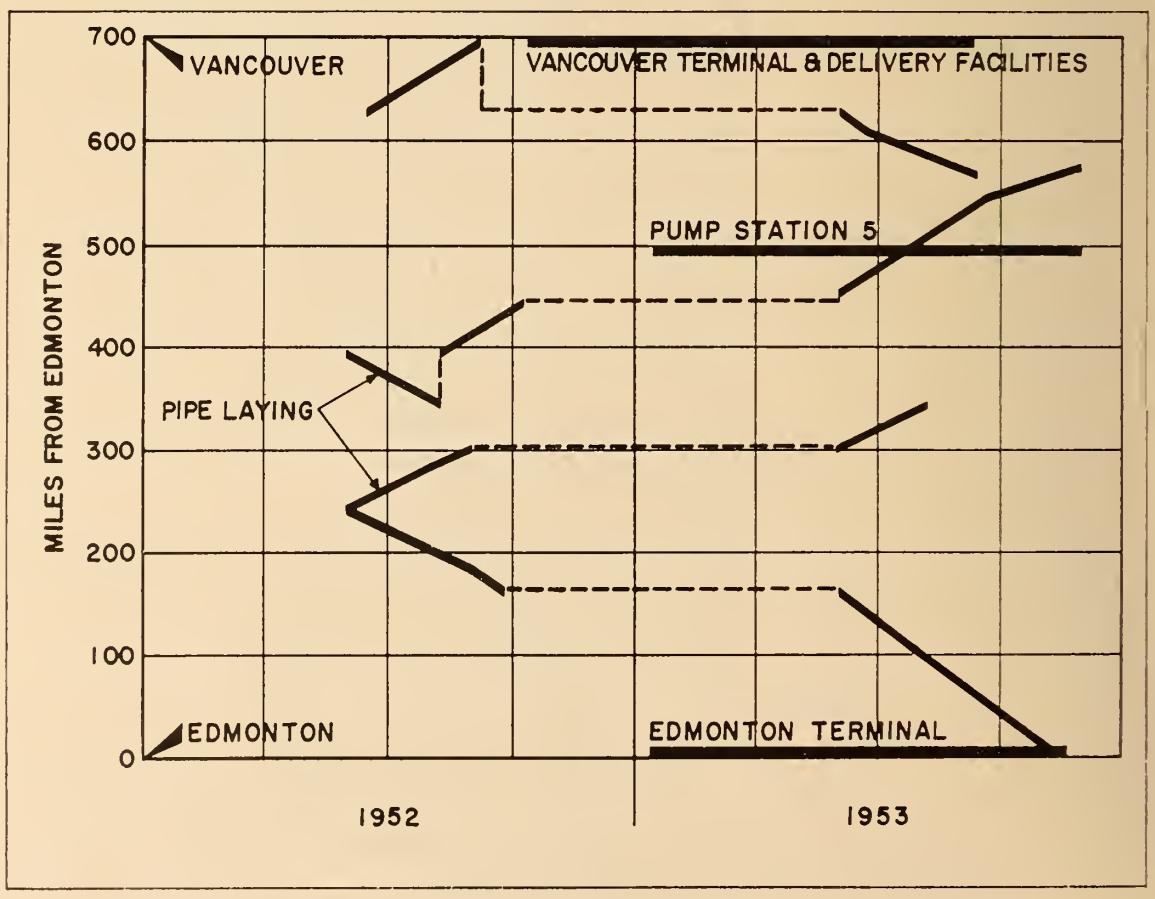

Fig. 4. The anticipated rates of progress in the construction of the pipeline, pump station 5 and terminals.

nominal diameter, then placed in a confining cylinder and hydraulically expanded to beyond its yield point. The maximum allowable working pressure used in design was based on 65 per cent of nominal yield strength, which varies from 52,000 p.s.i. for ⅜ inch pipe and thinner, to 46,000 p.s.i. for pipe over 7/16 inch thickness, and a 10 per cent minus tolerance on nominal wall thickness.

As protection against temperature changes, the line will be buried with a normal cover of 30 inches over the pipe. In rocky areas the cover will be reduced to 24 inches. East of the Rocky Mountains, where severe winter temperatures are common, a 36-inch cover will be provided. Although corrosion is considered a minor problem, particularly on the western slopes, the line will be coated and wrapped. The only expansion provisions are slack loops placed in the line when it is lowered into the ditch.

Extra heavy pipe, ½ inch, will be used at all river crossings, buried a sufficient depth to protect the pipe against scour in the bottom of the river. Cast concrete weights bolted to the pipe overcome any buoyancy, and tend to seat the pipe firmly in its trench. At major rivers, block valves will be placed on either side. Valves will also be placed at approximate 20-mile intervals.

Some of the Alberta oils have a high wax content, which precipitates on the inside wall of the pipe at low temperatures. During winter months, scrapers will have to be run through the line once a week. Traps to remove the accumulated wax and the scraper are to be built into the line at 125-mile intervals, or at pumping station locations.

Pump station design is standard, and embraces no special features of note. The prime movers will be diesel engines, operating on crude oil from the line. Centrifugal pumps, driven through speed increaser gears, will move the oil through the line. In the initial installation of two pumping stations, two 800,00 bbl. tanks will be erected at the Kamloops stations. One of these will float on the line at all times, providing an open system type of operation. Surge studies now in progress, and actual operation of the line, will determine whether future operations with additional stations will utilize the open or closed system, or a combination.

Communications between terminals and pumping stations and along the line will probably be provided by a teletype or telephone circuit, with mobile short wave radio contacts at patrol points. The modern method of patrolling pipelines is by airplane, but weather conditions in the mountains prohibit this. Thus many miles will have to be patrolled in four-wheel drive vehicles or on foot. A radio system was considered, but its cost is prohibitive.

Trans Mountain Oil Pipe Line Company plans to segregate the oils from the various Alberta fields into four groups for batching through the line. Two 150,000 bbl. tanks for each group will be erected at the gathering tank farm near Edmonton and at the terminal tank farm near Vancouver — a total of 16 tanks with 2,400,000 bbl. capacity. Loading facilities for off-shore shipments are still in the study stage.

Construction

The present construction schedule contemplates completion of the pipeline, two pumping stations and tank farms at the eastern and western terminals by the end of 1953. Fig. 4 illustrates the major items of construction, and more particularly the anticipated rates of progress on various sections of the line.

Weather is one controlling factor in this schedule. Some phases of pipeline construction, i.e. coating, wrapping and welding, require mild temperatures and dry weather. The work season for these operations is limited in the average year to June through October. Other operations such as clearing of right-of-way can be carried on to advantage in the fall and winter months when the fire hazard is at a minimum. The exterior work at pumping stations near Edmonton and Kamloops is limited to 5 or 6 summer months. Interior work can be carried on in winter by providing temporary heating. Construction of the Vancouver tank farm and terminal will be hampered by rain at all times of the year, but temperatures are mild.

The other controlling factor is that which plagues all private construction projects in these times of defence preparation — availability of materials. Fortunately this project merits support of the Canadian and U.S. governments from a defence aspect, so the major item of steel pipe is being made available. Forty-two thousand tons (210 miles) were secured for the second quarter of 1952, and 35,000 tons for the third quarter (170 miles) to complete 380 miles of the line this year. Unless there is a major disruption of the steel situation, pipe deliveries will continue through next winter in sufficient quantity to allow completion of the line in 1953. Pump and engine deliveries and the existing shortage of plate for tanks will throw the major portion of pumping station and terminal construction into 1953.

It is planned to deliver all materials to sidings along the jobsite by rail. Access roads will be built from the sidings to the right-of-way and material will be hauled into position with light trucks and tractor-trailer units. As many sidings as possible will be used to minimize the length of haul by truck. There is a popular misconception that the pipeline will have a highway paralleling it. This is not the case: roads built during construction are of a temporary nature only, and stringing pipe along the right-of-way will be so difficult in places that Caterpillar tractors will have to pull the trucks up steep grades on one side and winch them down the other, or carry the pipe into position piece by piece.

Contractor's forces and inspectors will be housed in mobile trailer camps or in work trains, as there are no towns along the line with accommodations for the 100 to 150 men required in each gang. Communication will be provided by teletype service between Edmonton, Jasper, Kamloops, Hope and Vancouver, and along the line by portable shortwave radio units carrying messages between the base camps and supervisors out on the job.

No unusual techniques will be required for construction of the line. The common practices developed in the past decade on thousands of miles of big inch pipelines will suffice. After the right-of-way has been cleared and graded, the ditch will be dug by ditchers or backhoes. Single joints of pipe, 32 or 38 feet in length, will be welded together by stovepiping. Each joint will be butted against its predecessor, and held in alignment by an internal line-up clamp while welders place the stringer bead and other passes necessary to a satisfactory joining of the two pieces of pipe.

After enough lengths have been welded together to provide a string several thousand feet long, a "clean and prime" machine travels along the string, removing mill scale and rust, and coating the outside surface of the pipe with a primer. This is followed by a "coat and wrap" machine, which places a coating of asphalt or coal tar enamel around the pipe, embeds a wrapping of fibreglass or glass floss in the

(*Continued on page 944*)

The Mechanical Plant of a Hospital

A Plea for Better Planning

by

Charles F. Neergaard

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A paper presented before the Montreal Chapter of the American Society of Heating and Ventilating Engineers, at Montreal, November 12, 1951.

Representing the hospitals' viewpoint, the author expresses criticism of wasteful heating and ventilating, based on his experience as a consultant over a period of many years. He shows by examples how operating costs can be sharply lowered without sacrificing the patients' comfort.

In discussing some of the hospital's mechanical services, I represent the consumer and you the producer. You engineers design our plants and specify or manufacture the heating, ventilating and air conditioning equipment—the heart and lungs of the hospital—and after you put it in, we have to live with it for 30 years or more, and pay the bills.

My experience with many hospital projects has given me a perspective on both price and values. For several years I have been assembling some rather significant data on extravagance in hospital engineering which was published in a paper called "Stop Burning up Hospital Money". The purpose was to highlight many oft-repeated mistakes which are constantly showing up in new plans, to urge the engineers, who design our hospitals to forget the way they have always done it, to start fresh with each problem, and analyse it in terms of todays' needs and today's resources.

No modern building presents so many problems of design as the hospital. The inter-relationship of its many departments, the technical requirements of its services, the varying ideas of its professional staff, administrator and department heads, must all be studied, appraised and integrated into a well-balanced, economically functioning whole. There are basic engineering theories which need to be re-examined. There are accepted practices which need to be challenged.

In the average hospital the cost of the heating and mechanical plant represents upwards of one third of the total investment. Its operation and maintenance bulk large in the yearly budget. There is generally no other department which offers such opportunities for substantial and continuing economies. It is often the only place where major savings can be effected without sacrificing something needed for the care and comfort of the patient.

Hospitals as an industry have never analyzed their precise needs. They have never formulated definite standards and performance specifications for the different elements of the mechanical services. They are notoriously overheated, but I have yet to see or hear of one that did not have heat enough.

In the absence of stated requirements each engineer has provided what he thought the hospital ought to have, and there is a surprising difference in engineering thinking. They usually err on the safe side, with excessive heating capacity, breakdown reserves, automatic controls and refinements. Because it is a hospital they often seem to feel that practically everything which mechanical art and science have developed is appropriate. As a result, too many of our hospitals have been mechanically overloaded with too large boilers, too much radiation, too many radiators, too much ventilation—all costing too much money.

When a hospital is to be planned the architect usually recommends an engineer with a long list of hospitals to his credit. Really the criteria for selection should not be how many hospitals a firm has designed, but how practical and economical they have proved in operation. When a patient dies in a hospital of an obscure ailment, they hold an autopsy. The doctors' mistakes are exposed before the patient is buried. When a hospital is built, its mechanical plant may happily be a sound investment or it may be an economic casualty. There is rarely a post mortem or engineering review of how well the last job worked before the next is designed. We, as consultants, make it a practice to check each of our jobs as it is finished and has been running a while, to look for troubles and mistakes. We certainly find a lot of them, but we aim never to repeat them!

Boiler Plants

A 200 bed hospital on sub-zero Prince Edward Island has operated satisfactorily for 20 years with a 60 h.p. boiler. A 50 bed hospital on Long Island, for zero design temperature, has specified a 150 h.p.

boiler. For a 150 bed hospital in Virginia with a plus 10 deg. design temperature and extravagant ventilation a 225 h.p. boiler is recommended. Each of these plants has a duplicate boiler as a standby. My old associate, C. E. Daniel, consulting engineer to the U.S. Public Health Service, who has designed many simple, economical hospital plants, states that the hospital boiler capacity may be roughly estimated at one h.p. per bed at 0 temperature. We have records of 13 hospitals with a total of 2,800 beds where boilers of one h.p. per bed—usually less—have carried the winter load, with a total boiler capacity, including standby, averaging 1.4 h.p. per bed. A comparison of these figures, with 6 general hospitals in New York City, with 2,900 beds, which have boiler plants averaging 2.6 h.p. per bed, is at least suggestive.

Most engineers specify two high pressure boilers, each sufficient to carry the winter load, entirely disregarding the fact that summer steam requirements are but one third of those in winter. This means that five or six months of the year a large boiler has to be operated at a fraction of its rated capacity. As modern boilers run most efficiently at 125 per cent or more above their rating, such a plant is wasteful.

We have found that the most economical boiler installation for a 100 bed hospital combines a 70 h.p. steel hot water heating boiler and two 40 h.p. 125-pound boilers, which save 50 h.p. as compared to the usual practice of two 100 h.p. high-pressure units. The hot water heating boiler costs less than the high-pressure units. It can be reconditioned in summer. The maintenance charges are lower as it will not corrode and requires no pumps. In the event of a breakdown, the two high-pressure boilers at 125 per cent rated capacity can carry the entire load.

I have never found anything better to heat them with than circulating hot water. It is surprising that so many engineers recommend a high vacuum vapor system, which in my experience is only "steam with a headache". The theory that it costs less than hot water and is equally effective, has many times been found fallacious. For years I have challenged both manufacturers and engineers to show me a vapor heated hospital where after a few years of use the radiators delivered the same gentle, comfortable temperatures as hot water, where in mild weather they do not get hot enough to burn your hand or fry the air.

Table I—Comparison of Radiation in Various Buildings With and Without Insulation

THE NUMBER OF CUBIC FEET IN THE BUILDING TO EACH SQUARE FOOT OF RADIATION

Hospitals Completed	Cu. ft. of Building	Sq. ft. of Radiation	No. of cu. ft. to each sq. ft. of Radiation	Insulation Walls	Insulation Windows
Prince Edward Island, Canada	550,000	5,100	107	Yes	Yes
Bethlehem, Pa.	750,000	3,750	200	Yes	Yes
Hagerstown, Md.	560,000	3,590	156	Yes	Yes
New Haven, Conn.	1,605,000	13,248	121	Yes	Yes
Toronto, Ont.	1,880,000	16,600	113	Yes	Yes
Hospitals Being Planned					
Scranton, Pa.	333,000	3,343	99	Yes	No
Long Island	514,000	7,320	70	Yes	No
New Jersey	425,000	6,600	65	No	No
Glen Falls, N.Y.	605,000	7,400	85	Yes	No
Virginia	1,137,521	23,813	47	Yes	No

Heating contractors roughly estimate heating plant installations @ $6.50 per sq. ft. of radiation, including boilers and equipment.

In the first group all except Prince Edward Island are wings added to existing structures.

Engineers differ widely in the amount of radiation which they specify for similar conditions. Compare the radiation used in a typical patient's room in three Northern U.S. hospitals. All of these rooms are identical in size, wall construction and windows. All have circulating hot water for the same requirements. At Portchester in a sheltered valley the engineer put in 62 sq. ft. of radiation and 1¼-in. connections. At Yonkers, with severe exposure, Daniel used 48 sq. ft. with ¾-in. main. In Hagerstown where the walls have 3-in. Porex insulation and the windows Thermopane glazing, 28 sq. ft. with ⅝-in. copper tubing has worked for 15 years. The significant thing is that in the insulated building there was sufficient saving in the cost of the heating plant to meet the extra cost of the insulated walls and windows.

In the U.S. Public Health Standards, Daniel recommends that:

> Heat requirements may be roughly estimated at one sq. ft. of radiation to 80 cu. ft. of finished space for uninsulated buildings at zero temperature. When the walls are well insulated the size of the heating boilers and radiators can be reduced approximately 25 per cent: if in addition the windows are effectively double glazed, 50 per cent—or approximately one sq. ft. of radiation to 160 cu. ft. of space.

These ratings are based on many completed projects, not on theory, and however much they may be challenged in terms of "the book", will serve as a rough basis for estimate.

Insulation

From the standpoint of economy and comfort, insulation is the most profitable investment that can be made in a building. In many jobs it has been conclusively proved that savings in the heating plant will cover the extra cost of insulating the walls and double glazing the windows. It is a strange commentary that over the years, to the best of my recollection, no engineer in the States has ever suggested the use of insulation for any of our hospitals, or when it was recommended, failed to question its cost and value, and if it was specified, made full allowance in designing his heating plant

Table II—Summary of Steam Requirements for a 100 Bed Hospital

Use	Maximum Horse Power	Steam Pressure	Hours per Day at Varying Loads
General heating system	68	2	24
Special heating, operating and delivery rooms	2	2	6
Domestic hot water supply	10	2	16
Laundry: Hot water	15	2	7
Steam	11	100	7
Kitchen and dishwashing	6	2-20	6
Sterilizing	10	40	5
	122		

Table III—Hospital With All or a Portion of the Buildings Insulated

No.	Location	No. Beds	Days Care	Total Cost	Power, Light and Heat Cost Per Bed Per Yr.	Power, Light and Heat Cost Patient Per Diem	Proportion Insulated
	Toronto, Ont.	547	175,488	$40,622	$ 74	$0.23	½
	Prince Edward Island, Canada	200	54,037	19,373	97	.36	All
	Hagerstown, Md.	170	57,783	27,718	163	.48	½
	Glen Falls, N.Y.	162	59,208	19,048	117	.32	½
	Bethlehem, Pa.	307	89,001	58,153	188	.65	¼

for the increased thermal capacity.

Insulation cuts four ways—it cuts the radiation, the size of the boilers, the engineers' fee and the client's fuel consumption for the life of the building. Another advantage is in summer comfort. There were long tests in hospitals with old and new wings, and recording thermometers showed that the insulated building averages 8° cooler than an uninsulated structure, and this without air conditioning.

One example will be suggestive of the operating economy. In 1947 a 547 bed hospital in Canada with only half of its total cubage in insulated buildings, spent $40,600 for power, light and heat, while a 520 bed hospital in New York City, with no insulation, spent $162,000.

Mechanical Ventilation

Mechanical ventilation has for years been one of the big hidden leaks in the hospital construction and operation budgets. Yet in my experience with nearly 300 institutions, the average hospital needs only effective exhaust fans for toilets and a few special departments, to remove steam and odors and to keep the air in motion. Given plenty of windows, a forced fresh air system is rarely if ever justified, considering the extra boiler capacity which must be provided to heat the additional air.

Many old hospitals, when they have found how much it costs to operate their big fans, and how really unnecessary the additional ventilation was, have shut down the fans, yet year after year they still have to pay the standby charges for electricity and overheat the building with the additional boiler capacity. Most engineers in the past have favored large central fans to put in and take out the air. Today most of these large fans have been replaced by small local fractional horse-power fans which can be used as and when needed.

Air Conditioning

When air conditioning first began to receive general consideration, the editor of *Modern Hospital* asked me to explore its value to the hospital and suggest whether the added cost was warranted in its therapeutic value to the patient, aside from its comfort factor. What can air conditioning do for the sick? A review of 100 articles which had appeared in scientific publications in the past five years disclosed no factual evidence of its therapeutic value for hospital patients, and in this respect there has been no change. No scientific proof was presented to justify hospitals investing in complete air conditioning.

It has been demonstrated that the death rate of premature infants was reduced from 28.9 per cent to 0.7 per cent when a high relative humidity (50-75 per cent) was maintained. It has been demonstrated that hay fever and pollen asthma patients while remaining in air conditioned rooms experienced relief comparable to that secured by desensitization, but when discharged to the outside atmosphere their symptoms returned with equal severity. In operating room and recovery wards conditioning contributes to the efficiency of the surgeons and to the recovery of patients in the post-operative stages. Aside from these groups, evidence of the clinical value of air conditioning to the general run of hospital patients appears to justify the Scottish verdict of "not proven".

In the fields of preventive medicine and industrial health the credible testimony found was largely negative. Two carefully controlled studies by a Life Insurance Company of the value of both winter and year-round air conditioning on groups of several thousand employees found no significant difference in matters of health, absenteeism or other pertinent factors between those working in air-conditioned quarters and those in rooms properly heated and ventilated.

Air conditioning is undoubtedly here to stay, but however efficient the engineer may be in designing the plant he cannot control its operation. When you consider this—that for year-round air conditioning there are six elements to be mechanically supplied and integrated, every step in the cycle must be properly balanced and controlled if the system is to work and all of the controlling gadgets—thermostats, humidifiers, anaemostats, filters—must be kept in perfect adjustment. That is where the trouble comes.

Shortly after one of our big medical centers was completed the engineer published a descriptive article in which he wrote as follows: "Temperatures are maintained within half a degree and with some changes now in progress it is hoped to maintain relative humidity within less than half of one percent." This was for the operating suite. Are such refinements necessary? Can any surgeon, nurse or anaesthetized patient detect a variation of 2 or 3 degrees in temperatures or can the most explosive gas used in anaesthesia react to a 1% fluctuation in humidity? Precision costs money and it is a practical question to determine how far it should be carried.

In hospitals as well as in most buildings, when the room is overheated people open the windows instead of turning off the heat. With air conditioning, when it is

Table IV—Hospitals Which are Uninsulated

2	New York City	520	152,686	$163,129	$314	$1.07
3	Brooklyn	341	96,966	117,897	346	1.22
8	New Jersey	284	71,856	71,367	251	.99
10	Long Island	236	69,040	77,023	326	1.12
13	Central New York State	218	66,323	43,509	200	.66
14	New Jersey	207	56,588	65,317	316	1.16
19	Northern New York State	150	41,959	27,828	186	.66
20	New York City	131	29,741	58,541	447	1.97
22	Connecticut	134	36,157	43,130	322	1.19
25	Long Island	110	32,843	36,775	334	1.12
29	Westchester County, N.Y.	100	28,261	33,975	340	1.20
35	Brooklyn	143	30,288	43,875	307	1.45

The local figures are from a group of hospitals with uniform accounting.

too cool, we usually shiver. The crux of the matter is the differential. If you go from a 90° outside back and forth into a 65° office, sooner or later you will probably pick up a mean summer cold and contribute to the penicillin consumption.

Much progress has been made in the past decade, but the man who attempts to make the weather and the man who lives with it both need a lot more practice before it will work perfectly. I think we have the answer in panel cooling, which I will discuss a little further.

Panel Heating and Cooling

In the cold winter of 1929 I worked for six weeks in the office of a London architect in a panel-heated room. It was a revelation in comfort, and I was astonished to find that the temperature ranged from 56 to 60°. It seemed the answer to the hospital heating problem. Through the courtesy of the directors of the London County Council which operated the city's schools and public buildings I was shown their records. Panel heated schools used 30 to 40 per cent less fuel than those with radiators. They ran a 12-week controlled test in two identical postal buildings; 43 per cent more fuel was used in that with hot water radiators than in the panel heated unit.

The London Central Bureau of Hospital Information published a report in 1937, based on the experience of 42 English hospitals covering 15 to 20 years, use of panel heating with an aggregate of 232 heating seasons. There were no leaks and no repairs to any of the embedded panels; cracks and discoloration of ceilings were negligible; less cleaning and less frequent redecoration were needed; control valves in each room were rarely used, the central control of the circulated water temperature in the boiler room being sufficient; warmth was evenly distributed and comfortable temperatures were maintained.

It is surprising to note how much further Canadian engineers have progressed in the adoption of panel heating than have those in the States. You are several years ahead of us. Panel heating here is receiving increasing consideration. However, engineers, architects and contractors who have had only limited experience with it generally maintain that it will cost 20 to 30 per cent more to install than a radiator job.

Two recent projects in our office indicate to the contrary. In one small hospital in Rhode Island alternate plans and specifications were prepared for a circulating hot water system and a panel heating, with prefabricated ceiling coils cast in a thin concrete floor slab. An experienced heating contractor bid and saved 10 per cent on a highly successful panel installation. We are advocating its use generally for new hospitals, and find increasing interest on the part of building committees, architects and engineers.

The unorthodox has always appealed to me. Ever since James Govan of Toronto ran cool river water through the heating system of a Canadian hospital, put pans under the radiators and let them drip, I have been intrigued by the possibility. Panel cooling has passed the experimental stage. Pioneered abroad, it is being widely studied here. Leopold in Philadelphia, Jaros in New York and Wiggs in Toronto have done a great deal of research, published several papers and are installing some interesting systems.

Table V—Hospital Boiler Plants which are Supplying Ample Heat and Steam with One Boiler Horse Power or Less per Bed

Location	Erected*	Bldgs.	No. Beds	No. Boilers	Boiler Horse Power Winter	Boiler Horse Power Standby	Approx. Space Insulated
Brooklyn, N.Y.	1918	3	100	2	100	100	0
Hagerstown, Md.	1936	5	158	2	130	130	⅓
Bethlehem, Pa.	1945	11	295	3	300	150	¼
Stamford, Conn.	1940	2	70	2	60	60	0
Bangor, Me.	1940	8	213	3	136	2 @ 60	¼
Rome, N.Y.	1939	1	135	3	109	2 @ 63	0
New Haven, Conn.	1941	8	385	3	300	150	½
Westchester County, N.Y.	1945	4	145	3	150	2 @ 100	0
Glen Falls, N.Y.	1936	2	162	3	150	150—60	½
Prince Edward Island, Canada	1937	2	200	2	60	60	All
Toronto, Ont.	1932	4	547	2	250	250	½
White Plains, N.Y.	1939	4	196	3	160	2 @ 106	½
Yonkers, N.Y.	1929	6	195	2	125	125	None
	Total Beds		2,801	Total Boiler hp. 3,923			
				Average hp. per Bed			1.4

*Date erected is for most recent building when usually a new, large boiler was installed to carry the winter load.

Only at Bangor and Rome were boilers designed economically to supply the reduced steam demand in the summer months. Rome has a 109 h.p. low pressure and two 63 h.p. high pressure.

Operation and Maintenance

Given a well-designed mechanical plant, how well it functions depends on the operating engineer. In the average hospital organization the engineer is responsible for the maintenance of the building and grounds, as well as the operation of the mechanical plant. The public is more sensitive to a broken shade or peeling paint than to a leaking steam valve or dirty boiler, so it follows that the engineer must give first consideration to the shade and paint while the valve blows steam and the heat from the boiler goes up the chimney.

The hospital superintendent takes the power plant as he finds it, hires the best engineer the budget will allow to run it, and is satisfied as long as the plant continues to function without shutdowns.

He knows what the plant cost to run last year, and is delighted if there is a saving this year—but how can he determine what it really ought to cost? In 18 hospitals in one city district, annual power, light and heat costs in 1948 ranged from $132 to $425 per bed; fuel costs along from 35 to 65 per cent of the total. A review of the figures of ten of these hospitals which I will show you is interesting as indicating the wide spread in what hospitals are paying in the engineering department.

Having his plant properly run is the consulting engineer's headache. I have often suggested to Hospital Building Committees that the engineer who designed the plant should be paid a retainer to inspect it at least twice a year, to make sure that it was being efficiently operated and maintained.

I will now add one fervent plea—if any of you design a hospital mechanical plant, make it flexible, make each facility just large enough to carry its load. Above all make it simple, for however scientifically you may plan it, someone else has to run it, and there—usually—is the rub! √

INTEGRATED FOREST PRODUCTS OPERATION

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

by

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There is probably more popular clamour for forest conservation than for any other form, perhaps because of all our resources the forest is the most visible. One way to conserve is to use more and waste less of the forest harvest. This paper tells how the wood industry through diversification of manufacturing capacity and methods and the gaining of market acceptance, is making important additions to volume and value of product from the same timber stands.

Integrated forest products operations are of considerable current interest. The past twelve months have seen accelerated progress towards integration on the part of many timber corporations, indicating a motivation close to economic necessity.

In the Coast Region of British Columbia, integration means the combination of timber stands and logging with converting units for the production of:

Sawn lumber
Plywood
Shingles
Pulp

including facilities for a horizontal movement of logs and salvage material between the converting units.

The function of an integrated operation is to convert the raw material in the timber stands to its highest utility as measured by gross value and by volume of product. This is the primary step towards conservation of forest resources, which, in this region, is the husbanding of the static, mature forest until the increment-producing young forest reaches a sustained yield condition. The timber will then yield its highest economic return. When integrated facilities are complete, the consumer, through his application of value, will direct the flow.

The basis for the provision of converting facilities is the timber in the stands. A recent estimate of the makeup of mature timber standing in the Coast Region gives the principal species as:

Douglas fir	24 per cent
Western hemlock	30 " "
Western red cedar	26 " "

with substantial amounts of balsam and Sitka spruce. This is the overall Coast distribution and amounts of each species will vary widely with individual holdings. In large areas of the Coast forest there is virtually no Douglas fir.

Douglas fir, with large amounts of clear wood and great structural strength, finds primary conversion to plywood and sawn lumber. Western hemlock is similar to fir in available clears and in strength and, with its associated species balsam, is also prime pulp material. Most hemlock and balsam will then go to the sawmill for primary conversion, with the pulp mill competitive for the low grades. The beauty, workability and durability of Western red cedar send its higher grades to the sawmill and shingle grades to the shingle mill. The large clears available in Sitka spruce, with fine texture, straight grain and high strength lead it to the sawmill for primary conversion.

As is clear from the foregoing, the

The author, J. O. McCutcheon, M.E.I.C. (right), chatting with R. L. Weldon, M.E.I.C., chairman of the session at which this paper was presented.

converting units must be in the main complementary and not competitive in their drawing upon raw material. In the fringe areas where they are competitive, the principle of highest return will direct the logs to their proper use.

The pulp mill will, in general, feed upon the leavings of the lumber and plywood mills, supplemented by those logs which are uneconomic to cut to lumber and by logging wastes. The pulp mill is then necessarily of a type which can utilize the species and types of chips developing from its sister mills.

The typical forest products operation on the Coast has begun with the sawmill and its associated timber stands. Profits from the logging and sawmilling operation have been plowed back to add shingle and plywood facilities, and further profits have allowed the provision of pulp facilities, the biggest step in integration, and the most costly.

All of these converting units are distinguished by the very large investments required. The announced costs of some recent installations may be of interest:

A gang mill was added to a Port Alberni operation for about..	$1,000,000
A plywood mill was built in Victoria for about.....	$2,000,000
A kraft pulp mill was built near Nanaimo for.....	$19,000,000
A pulp and paper mill is going up near Elk Falls for about.....	$40,000,000

All of the facilities listed are parts of integrated operations and it is obvious that their investors must, in each case, be assured of raw material supplies sufficient for a considerable period. Large timber supplies must be recognized as a basic requirement when assessing the benefits of integrated operation in the forest products industry.

The basis of measurement of raw material is the British Columbia log scale, a scale developed, as noted in the official foreword, "to allay the friction existing between millmen and loggers throughout the province". This scale serves its purpose well, but in order to illustrate comparative volume recoveries, the cubic foot is used in this paper, showing its equivalence in log scale where applicable.

The Sawmill

The sawmill was the beginning of the forest products industry and it remains the center of an integrated operation.

The typical Coast sawmill originated as a green mill, built to service the waterborne export trade and operating primarily on high quality Douglas fir. The first steps towards integration were the expansion of remanufacturing facilities and the addition of dry kilns and planing mills. These extended facilities allowed the mill to meet the requirements of the diversified domestic rail market and, in so doing, to add to its species cut and to increase grade recovery from its input.

Extreme flexibility in cutting, drying and dressing is a characteristic of the present Coast sawmill which must be prepared to enter any of several export markets as well as the rail market, all with widely different requirements. Specialty mills, cutting only cedar or hemlock of spruce, have developed, but these are few in number. The usual "fir" mill cuts all species coming out of its timber stands.

Shingle mills, with their ability to take raw material in short blocks, offer a means of obtaining a high-grade product from lower grade logs, in addition to an entry to a periodically valuable market, and have been a natural accompaniment to the sawmill. The plywood mill followed as a logical extension of manufacturing facilities.

Changes in log input to the sawmill followed closely. Peeler grades of Douglas fir, formerly the source of large clears and timbers, are reserved for the plywood mill. The sawmill must now extend its clear

View of lumber operations at Port Alberni, showing pulp mill (top left); sawmill and shingle mill; Government assembly wharf; sawmill and plywood mill (centre foreground).

order file with hemlock, spruce and balsam, and large size timbers in quantity are no longer available.

Further changes in log supply arise from a decreasing log diameter as logging moves to higher elevations and as smaller logs are brought out of the woods; the decrease in fir diameter being emphasized by the plywood absorption of a large percentage of the 20 inch and over diameters. Swede gang saws, with a reduced saw kerf, are desirable for small peewee cutting, but have little flexibility for thickness selection. Small band mills, using thin-bladed saws, offer more flexibility and may be a better overall solution.

These developments, added to by the many years of overcutting of fir in proportion to its occurrence, are requiring a profound change in the traditional markets for Coast lumber. The market acceptance of hemlock, balsam and cedar for finished clears, boards and dimension is a vital factor in the success of integrated operations in the Coast forest products industry.

Western hemlock, one of the strongest and stiffest of the world's softwoods, is interchangeable with fir for many structural uses, particularly with the availability of timber connectors permitting high stress utilization of dimension sizes. Extended drying facilities have now enabled the major mills to handle kiln dried hemlock boards and dimension, which, combining high strength with low weight and low moisture content, offer many interesting possibilities in construction.

While the combination of expanded facilities with diversified order files have helped absorb other species and maintain or improve the lumber out-turn, the major improvement in recovery from the log occurred with the addition of a pulp mill capable of operating on sawmill out-fall, followed by a chipper installation in the sawmill. This made available immediately a market for a further 9 per cent of the log, merely by the selection of bark-free waste. With capital expenditure for the hydraulic barking equipment which has become available in the last few years, this figure can be approximately doubled with use of a slab barker, and tripled with use of a whole log barker. To find a profitable market for an additional 27 per cent of the raw material intake represents a tremendous step in integration, a step, however, which involves very large expenditure—of the order of $750,000.00 for a whole log barker and chipper installation—and only practicable for a large sawmill with the assurance of many years' timber supply.

Volume disposal of the log has shown some significant changes. In the original mill, operating individually on a timber stand, a thousand feet of log represented about 160 cubic feet. Lumber out-turn ran about 93 cubic feet, or about 58 per cent. Of the remaining 42 per cent, about one-quarter to one-half was used or sold for fuel and the remainder burned as waste. This burning of waste was in fact one of the largest operating problems.

In the present-day integrated sawmill, with a smaller average log size, a thousand feet of log intake represents about 175 cubic feet. The same lumber out-turn is now 53 per cent of the intake, and with a whole log barker, pulp chip output as stated earlier can reach about 27 per cent of the intake. Useful product output of the mill has then risen from 58 per cent to 80 per cent of the input.

The lumber out-turn given above is as measured before dressing, that is, by its nominal size. Dressing losses, appearing in the form of planer shavings, might average up to 30 per cent of the rough size and reduce the solid lumber out-turn accordingly. While it is probable that consumer uses will develop for these shavings, they are now being burned for fuel and, in the case of construction grades particularly, it is likely that they would be of better service to the community if left on the lumber. If the construction industry can find it acceptable, accurate saw sizing of dimension, even if only on the flat sides, would stretch the log by over 20 per cent.

Despite the changes in log supply noted, utilization, as measured by gross value of output, has improved as the volume of useful product increased. Taking into account the pulp mill conversion of its chips, the integrated sawmill, through the application of increased fixed investment and increased labour, is able to improve gross value of output by approximately 35 per cent.

Wood waste available for boiler fuel has been reduced to about 20 per cent of the log, supplemented by wet bark and by planer shavings from such lumber as is dressed. New consumer uses for this remaining material—some already exist and others are in sight—would tend to make the sawmill a purchaser of fuel or power or both. Even in the present and still imperfect stage of integration, the days of salvage of free waste are over.

The Plywood Mill

During 1952, it is likely that about 12 to 13 per cent of the Coast production of Douglas fir logs will go into the manufacture of rotary-cut fir plywood. In individual integrated areas, with suitable stands, this figure has approached 50 per cent. When it is considered that this includes virtually all fir logs with any amount of clears, the effect of the plywood mill on the integrated operation becomes evident.

The fir plywood business developed out of the demand for three-ply for panel doors. It was not until the period beginning with the war years and the introduction of waterproof glues, with the tremendous broadening and diversification of markets that followed, that the plywood mill assumed its present important role in the integrated operation.

While volume recovery in a plywood operation is not much different from that in a sawmill, the gross value of product is considerably greater, and it represents a much higher form of utilization.

Plywood log usage has changed considerably since the early days, conforming to the change in log supply. Minimum diameter has dropped from 30 in. to 20 in. and will likely go lower. Grade usage is now apt to include 60 to 70 per cent of No. 3 and No. 4 peelers. Chunks and "sweep" logs find high utilization in the plywood mill.

The average thousand feet of log intake to the plywood mill, containing a large percentage of butt logs, represents about 150 cubic feet An efficient plywood plant will convert about 83 cubic feet of this or 55 per cent to plywood measured on the unsanded nominal basis.

About 9 per cent is dropped from the lathe as a core and is available for conversion into ties, studding or pulpwood. As the veneer must be brought to virtual bone-dryness, a further 6 per cent is released as moisture.

This leaves about 44 cubic feet per thousand feet of log or 30 per cent as waste of various forms. As the first operation on the mill floor is barking of the block, this waste is all bark-free and when of sufficient size and not contaminated is available for immediate conversion to chips. In practice, about 23 per cent can be brought to chip form. The remaining 7 per cent is glue-contaminated waste, sawdust and jointer dust and generally goes to the hog. The glue-contaminated waste is available for chip conversion for some pulp operations

where light colour is not essential.

Overall volume utilization is fairly complete in the integrated plywood mill and the problem becomes one of obtaining the highest grade utilization, i.e., increasing the volume and grade of veneer obtained from the log. These efforts are spurred by the present high levels of peeler log prices. Present trends in equipment and process design are tending to increased volume recovery by reducing core, trim and handling losses, and to increased grade recovery through improved patching and joining facilities.

So far there has been no serious volume of plywood manufactured from the other principal Coast softwoods. Both hemlock and balsam can be handled, with some extension of drying facilities, in fir manufacturing units, but they do not develop the soft-textured face veneer available from old-growth fir. Cedar is not generally suitable for rotary peeling and, while clear flitches can be handled in a slicer, the face veneer developed is too soft for many present fir plywood uses. Second growth fir offers much the same problem in lack of face stock as do hemlock and balsam.

There is now in evidence a trend towards the combination of lower grade veneers with various types of face overlays, chiefly plastic-impregnated papers and hardboards, utilizing the high strength of the core with the special characteristics of the faces. The lower grade veneers could, for most uses, be extended to include hemlock and balsam and, as the papers and hardboards noted above are both pulp products, the composite boards produced could be considered to be logical extensions of the integrated operation.

A considerable portion of the fir plywood now produced is of sheathing grade, marketed for a large number of construction uses. Hemlock, with its high strength qualities should be particularly well suited to this grade when required.

A common extension to the plywood mill is a flush-door manufacturing unit. This serves as a high-quality market for plywood and for small sizes of lumber factory grades which would be difficult to market.

As presently constituted, the plywood unit uses by far the most man-hours per thousand feet of log and develops the highest gross value of product. Taking into account the pulp mill conversion of its chips, the addition of the plywood mill to the integrated operation has improved the utilization of the peeler grades of fir by about 275 per cent. This important gain to the economy of the province is made possible through the provision of large fixed investment—on a log input basis, four to six times that of a sawmill—and through the application of approximately 4.2 times the labour required in a sawmill.

The Shingle Mill

At present approximately 50 per cent of the Coast production of Western red cedar logs goes into the manufacture of shingles. With the shingle mill operating as a unit of the integrated operation, these logs are mainly the tough large-knotted type, and the surface clears and peewees go to the sawmill for manufacture into lumber.

High-quality shingles can be made from low-grade logs by virtue of the characteristics of shingle manufacture, which is a continual process of cutting to eliminate defect. The major log defects can be sawn out or split out in forming the block and the shingle is trimmed to remove edge defect.

With the production of a sawn unit as thin as a shingle, the saw kerf waste is necessarily very large, amounting to over one-third of the volume intake. When the waste from spalls and splints is added to this, it gives the shingle mill a lower product recovery than either the sawmill or plywood mill.

With the high taper common to cedar logs, the average thousand feet of log entering the shingle mill represents about 175 cubic feet. The shingle out-turn in an efficient mill is about 72 cubic feet, or 41 per cent of the input. Of the remaining 59 per cent, sawdust is estimated at 35 per cent with the spalls and splints making up the balance. Utilization of this shingle mill waste has so far been limited to fuel, either as boiler fuel in the operating unit, or, through further processing, as a compressed form of consumer fuel.

Utilization of the shingle log input, as measured by gross value of product, varies widely with the market, but will be about 55 per cent of that of the integrated sawmill, reflecting the lower grade of log used and lower recovery. Further manufacture of the waste to compressed consumer fuel can raise this figure to 60 to 65 per cent.

Manufactured roofings have eaten into the traditional cedar shingle markets, with cedar-roofed buildings dropping from close to 50 per cent to below 10 per cent. The market trend appears to be to cedar sidewalls, with the shingle mill supplying a pre-grooved and pre-stained shingle, thus transferring part of the construction labour to the manufacturer. These sidewall "shakes" are generally the equivalent of the No. 1 Perfection shingle grade, but because of their large exposure, require considerably less volume to the square.

Efforts in the shingle mill today must inevitably be directed towards increasing the potential market, both for the primary product and for the out-fall.

The Pulp Mill

The present function of the pulp mill in the integrated operation is to convert to its highest possible utility the out-fall from the sawmill and plywood mill and to provide an economic outlet for many logs unsuited to lumber, which were formerly used for fuel or left in the woods.

As the mature Coast stands are cut and the industry progresses to sustained yield operation on the second crop, the pulp mill can be expected to operate on an increasing percentage of whole logs, serving as the most economic utilization for thinnings and other material not of sawlog caliber.

The usual type of pulp mill which has been fitted into the integrated operation uses the sulphate process, producing unbleached or bleached kraft. This is a high-grade and desirable wood pulp which can be produced using up to 100 per cent of sawmill and plywood mill waste as raw material. The pulp out-turn is of the order of 45 to 50 per cent of the cubic foot intake with the balance, in the form of liquor and of screenings, serving after further processing as boiler fuel.

Hardboard manufacture is another type of pulp operation capable of using sawmill and plywood waste. While, measured on a value basis, hardboard is of a considerably lower grade than kraft pulp, it has some desirable characteristics for the integrated operation. Chip requirements are less strict than for kraft, volume recovery is considerably higher, and capital investment is much lower. There is some evidence now that there may be room in the integrated operation for both kraft and hardboard, and recent developments in the United States involving the production of hardboard containing substantial amounts of bark may add to this trend.

Softboard, or insulation board, manufacture is also possible from

sawmill and plywood mill waste, but interest in this process as an integrated unit has apparently been superseded by kraft and hardboard. This lowering of interest is probably due to the lower value of the softboard out-turn, and the present large installed softboard capacity which would appear adequate for the known markets.

The emergence of the hydraulic barker has been an important factor in the success of the integrated pulp operation by allowing improved chip recovery from sawmill waste, from "wood" logs and from small whole logs. Full utilization will likely require a whole log barker for the main sawmill intake, a small log barker at the sawmill if peewees are going to be sawn in quantity, and, unless the sawmill is next door, a whole log barker at the pulp mill.

While there are instances where pulp producers, operating on whole logs, have acquired sawmilling facilities in order to expand the gross value of their timber, the usual pattern on the Coast has been that pulp facilities have been the last unit acquired, requiring many years of reinvestment of earnings from the primary producing units. The future trend, however, will almost certainly see the pulp facilities becoming the dominant unit of the integrated operation from the standpoints of both raw material requirements and earnings.

Logging

Integration of the forest products operation must necessarily make logging into a servant of its converting units. The ability of the integrated operation to convert the various species and grades to their highest utility can only be realized when the timber supply is balanced with manufacturing facilities and order files. While a fir peeler inventory must be maintained for the plywood mill, market conditions may make it undesirable to log a proportionate amount of fir sawlogs. Log supply is most flexible when the trees are still standing and the trend is to a reduction of log inventories.

These conditions and the gradual retreat to less accessible timber, have led to the conversion of the typical Coast integrated logging operation from railroad to truck logging. This changeover, while involving large capital expenditure, offers some important advantages. With increased grades and sharper curves, less accessible areas can be reached. Tributaries to the main access roads can be put in fairly readily to reach any desired section. Maintenance costs are considerably lower than rail, permitting the logging operation to take out only part of the timber when the road is first installed. Winter logging is generally possible, allowing the converting units to operate on smaller inventories. Large cold-decking is unnecessary, eliminating a source of degrade. Access roads are available for fire control.

For high utilization, log length becomes important, particularly for the peeler grades. The trend is now to the taping of logs ahead of the buckers.

The economic recovery per acre is increased. The plywood mill, operating on an 8 ft. 6 in. block, allows the recovery of chunks and "sweep" logs, perhaps an additional thousand feet per acre. The Swede gang mill, using logs down to 6 in. diameter, may allow up to a further four thousand feet. If pulp mill capacity is in excess of sawmill and plywood chip supply, logging waste amounting possibly to another four thousand feet may be salvaged.

To illustrate the improvement possible in gross value per acre, two acres containing equivalent amounts of merchantable timber will be considered:

An individual fir mill, cutting all the logs to lumber and burning the outfall, operated as long as possible on highly selected stands, with perhaps a fifty thousand foot acre divided:

70% fir
15% hemlock
15% cedar.

By contrast, the integrated operation is working stands in balance with its timber reserves where a typical acre might have:

20% fir
42% hemlock
15% balsam
23% cedar

making up the fifty thousand feet.

It is possible to add to this:

1 thousand feet plywood salvage
4 thousand feet gang mill salvage
4 thousand feet pulp salvage

raising the total yield of the acre to fifty-nine thousand feet.

Although operating on an acre with a much lower proportion of fir, the integrated operation, through its ability to increase the volume yield and to direct all material to its best conversion, is able to raise the gross value of product per acre by approximately 70 per cent.

The move to balanced cutting of species was inevitable and this large increase in available yield per acre is, to a competitive industry with high labour costs, high log prices and increasing stumpage, the spur to the drive to integration.

This can be considered equivalent to a similar increase in the life of the mature forest resources. In addition, integration has meant the investment of many millions of dollars in converting units, followed by a large expansion in employment. All these effects are tremendous contributions to the economy of this province and to all of Canada. √

TRANS MOUNTAIN OIL PIPELINE

(*Continued from page 935*)

coating as reinforcing, and then wraps an asphalt felt over the whole to protect it. The pipe is then lowered into the ditch by sideboom tractors, the tie-in weld connecting the string is made, and backfill is placed over the pipe.

The sections of the line constructed in 1952 will not be tested that year, because of the danger that some water, not completely blown out or drained after testing, will collect in the low spots, freeze and possibly burst the pipe. It is planned to test the entire line immediately after it is completed, and just prior to filling it with oil for initial operation. √

Future Annual Meetings

ANNUAL MEETING, 1953 . . .

Nova Scotian Hotel, Halifax, N.S., May 20-22, 1953

ANNUAL MEETING, 1954 . . .

Chateau Frontenac, Quebec, Que., May 12-14, 1954

Rural Electrification in British Columbia

by

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A paper presented at the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, May 7th to 9th, 1952.

This paper records the problems and progress of rural electrification in British Columbia. It has little technical content, but gives a good idea of difficulties encountered and how they were solved, and on account of the financial and economic basis of the province's rural electrification program.

Electrical energy has become one of the most highly valued resources of any country. Without it our larger cities would not have grown and, having grown, would not continue to exist. Less spectacular, but certainly not less significant, is the availability of electrical energy in rural areas. It means a life of greater convenience, comfort and freedom from drudgery; it means new methods, new possibilities, new courage and new hope.

As electrical systems have grown, the desirability of supplying energy to "rural" areas has received recognition and rural electrification projects have come into being.

This paper considers the decade of 1942-1952 in British Columbia. The problem there was, and is, one of planning, economics and financing; hence this paper will deal mainly with these aspects of the rural electrification programs of the Province.

British Columbia's Problems

Rural electrification cannot be made independent of other phases of the utility business, which must average its costs and its charges over wide areas. If rural electrification is to be carried out successfully it must be built upon central station operation of sufficient capacity and urban business which is on a sound footing. A consideration of British Columbia's geography and distribution of population will indicate that herein lies her rural electrification problem.

In 1941, British Columbia's population was 818,000. Over one third of these people lived in Greater Vancouver and New Westminster. The area known as the "Lower Mainland"—Vancouver, New Westminster and the lower portion of the Fraser River Valley—contained 55 per cent of the population of the province. The southern tip of Vancouver Island held a further 10 per cent of the population. A further 10 per cent of the population lived in twenty centres of from one to ten thousand inhabitants, averaging 3,800 each. The remaining 25 per cent of the people, or approximately 205,000, lived in widely scattered communities of fewer than 1,000 people. Figure 1 presents this picture.

Parts of this last group were receiving electric service in 1942. Some were served by extensions from the utilities of the smaller cities; some supported a utility of their own.

Present day standards of electrical

Garth Griffiths, M.E.I.C. (left), whose paper is suitably "plugged" by the lady on the photo in the background, is shown with his session chairman, L. L. O'Sullivan, M.E.I.C.

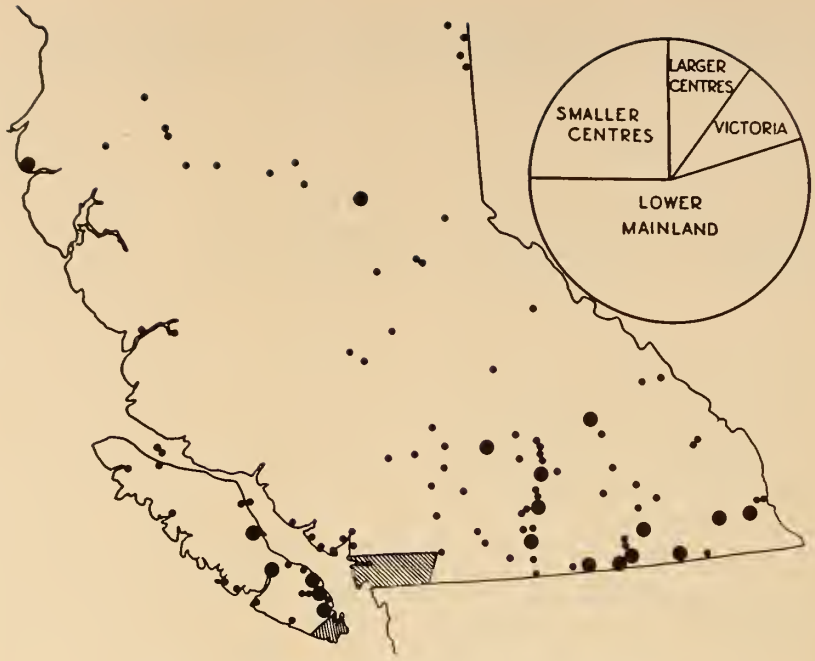


Fig. 1. Distribution of population in B.C., 1941.

service require that it shall be available at reasonable rates. In 1942 these standards were met only in the more populous areas of the Province. Such standards also call for central station capacity to meet any demand even in the more favoured areas there loomed, in 1942, the possibility of demand early exceeding supply.

The problem in 1942, then, was threefold. First, the adequacy of generating capacity must be assured; second, service must be improved in areas of low standard; and third, areas within reach of existing systems must be considered.

Status in the Early 1940's

Early in the 1940's the central station situation in the province presented several problems. Increasing supply had to be maintained in served areas and to be extended into unserved areas. Additional hydro capacity had to be brought in. Many small internal combustion stations were loaded to capacity and sometimes obsolete. Rehabilitation and expansion were required. There was the problem of financing development.

The second problem was that of raising the standard of service in certain areas to meet modern concepts. The potential customer must not be expected to make any large contribution toward construction, and must have adequate supply available at attractive rates. He must be able to buy electrical energy at low unit cost.

Sixty-five separate organizations were engaged in providing often inadequate central station service in the province in the early 1940's; of these a number lacked the financial resources to provide the additional capacity needed if consumption were to be encouraged, nor could they afford to lower rates.

The third problem was the extension of service from existing systems. A survey indicated that approximately 10,000 could be so served customers.

The fourth problem was that of providing service to scattered communities, small and remote, which had no service.

Any solution of these problems through construction of new plant was hampered by wartime conditions, which had also created a backlog of maintenance. When the war's end eased conditions somewhat, there set in a price spiral which affected the economies of all planning.

An Approach to the Problems

An approach to the province's rural electrification problems was made on April 19, 1943, when the Government appointed the "Rural Electrification Committee". The Committee was instructed "to survey and report upon the extent and condition of electrical services in the province, with particular reference to the servicing of rural areas".

The Rural Electrification Committee made its final report to the Government in January, 1945. The following is taken from the summary of its findings:

> Except on the Lower Mainland, including the Fraser Valley, the cost of electric service throughout the rural areas is high, the quality of service is low, and the average use is also low.
>
> Of the 207,000 customers in the province, 38,000 may be classified as rural; many of these could not be served at existing rates but for their proximity to more densely populated areas.
>
> A number of the supply organizations have insufficient capacity for material extension and have not the financial resources to provide additional capacity.

The report observed that some of the larger companies could secure the capital necessary to carry out required expansion, and that in these instances the cost of rural extension would have no appreciable effect on urban service. It noted that a provincial grid system was not practical because of the wide distribution of the population and stated that no material extension of rural electrification on a self-sustaining basis, nor improvement of service in towns and villages, could be made without a major reorganization of the central station industry.

The Committee pointed out that rural electrification could not be accomplished as a separate business; that it must in some degree be an expansion of the established central station industry. There is, said the Committee, an element of internal subsidy in the utility enterprise, which operates on averages, and rural electrification is achieved by widening the areas over which certain average costs are applied.

Progress in Central Stations

The middle and late 1940's saw considerable progress made toward the solution of British Columbia's rural electrification problem, the first phase of which was the assurance of adequate generating capacity.

Generating capacity available to the Lower Mainland was approximately doubled as a result of the British Columbia Electric Railway Company's central station expansion at Bridge River, Ruskin and Lake Buntzen. Adequate supply to the metropolitan area of Vancouver was thus assured and the position as to rural electrification of outlying areas was improved. The installed capacity available on the Lower Mainland is now 377,800 kilowatts.

On Vancouver Island the situation was brightened when the John Hart Project of the British Columbia Power Commission commenced pro-

duction at Campbell River. The installed capacity now available on Vancouver Island is 118,200 kilowatts.

Available generating capacity in the Okanagan-Kamloops area was increased in 1951 by the completion of the first stage of the British Columbia Power Commission's Whatshan development. This area now has 27,700 kilowatts of installed capacity available.

In 1945 ten of the smaller utility operations in the province were brought under unified management when they were acquired by the Power Commission. These operations depended totally or in part upon diesel generation. Later, more such areas were added until 18 diesel generating plants were operating under one management. This consolidation made possible rapid improvement of the supply situation in these 18 rural communities. Standard designs were introduced and unsatisfactory equipment was eliminated. Over 11,000 kilowatts of diesel generating capacity are now available in these districts.

The construction of these additional hydro generating facilities and planning for still more hydro capacity, coupled with the reorganization of many of the diesel generating stations, provided a firm base for improved and extended service to rural communities and districts.

Transmission Grids and Average Costs

Electrical supply involves transmission as well as generation. In British Columbia geography makes a province-wide grid system of transmission impractical. Developments of the past decade have, however, led to the construction of certain new systems and to the expansion of existing systems; there are four transmission nets now operating (see Figure 2). This growth has allowed the decommissioning of three steam plants and seven diesel stations and will extend to more.

The water powers of the province belong to the people of the province as a whole, not to any particular group. Acceptance of this principle has led, in the operations of the British Columbia Power Commission, to the averaging of generating costs, resulting in a single wholesale rate chargeable in all areas. In other provinces, and in certain parts of this province, tangible transmission nets have brought low-cost energy to rural areas. In British Columbia there has also been set up an intangible transmission grid. The impracticability of physical connection, by conductors, has not been permitted to retard the development of remote communities. These communities purchase power for distribution at the overall average cost of generation and transmission for the whole undertaking within the province; they may thus be regarded as linked by an intangible network.

In addition to having an assured supply, rural areas can purchase energy at rates comparable to those charged for hydro power. Thus there is a cumulative process of load building which increases the feasibility of physical transmission; as one area becomes accessible to the physical net, another new and remote area may be added to the intangible net. Average costs are thus being applied over an ever widening field of operation.

Improvement of Substandard Service

The second major problem of the early 40's was improvement of substandard service received by many communities, notably those served by the smaller utilities. Accomplishments in the field of rural electrification cannot be gauged entirely by the number of added connections. Electrification, rural or otherwise, means not only the provision of energy to an area, but further the provision of energy in adequate quantity, at rates which will encourage increasing use.

Figures published in the annual report of the Power Commission offer a convenient comparison of average rural usage and cost from year to year, set up by classes of service. Similar tabulations are not readily available for the electric utility industry in the province generally; therefore a few representative examples of the Power Commission's operations will be reviewed here.

In 1945, 12 power districts were consolidated under the Commission's management. Two of these districts averaged 5,600 customers each, the other ten averaged 200 customers each, truly rural systems. The operation has now grown to 25 districts, shortly to become 27. Of the present 25 districts, 19 have fewer than 1,400 customers each, and average 523 customers each. These districts are representative of British Columbia's rural and village communities, isolated as they are from large electric systems. The majority are growing rapidly; some have grown as much as 1000 per cent since 1945.

The Village of Vanderhoof is situated on the Nechako River, west of Prince George. Its population has remained comparatively static over the past few years. 106 customers were served in 1947 and 270 in 1951. Consider, however, the changes in the use of electricity which have come about. In 1947 there were 78 residential customers, using an average of 49 kwh. per month for which they paid $5.00 each, or 10.2c per kwh. By 1951 there were 188 residential customers, using 138 kwh. per month each, at an average unit cost of 3.7c per kwh.

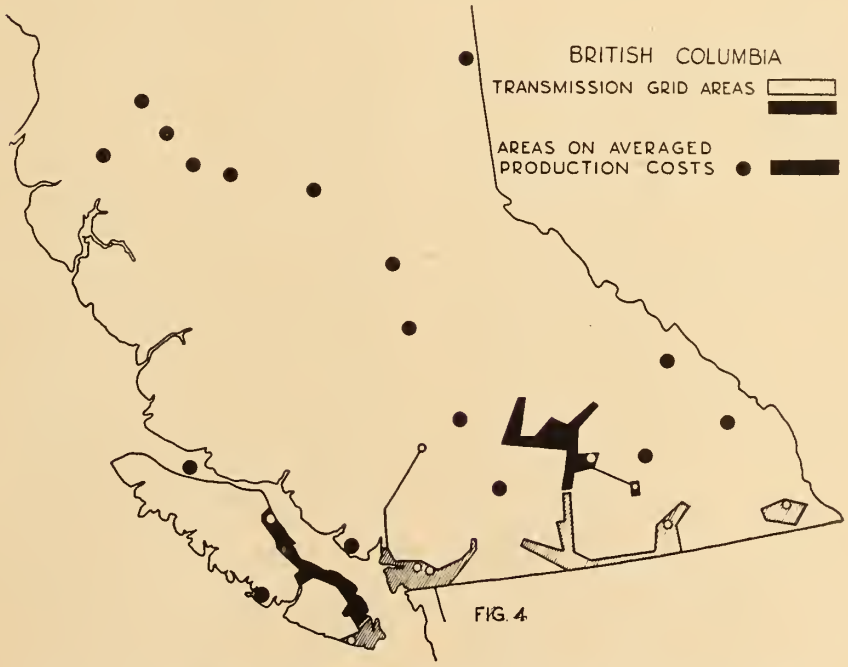


Fig. 2. Transmission grid areas and areas on averaged production costs in B.C.

	Urban	Rural	Total	% Rural
1941	140,000	30,000	170,000	18%
1951	208,000	72,000	280,000	25%
Increase	68,000	42,000	110,000	
	49%	140%	65%	

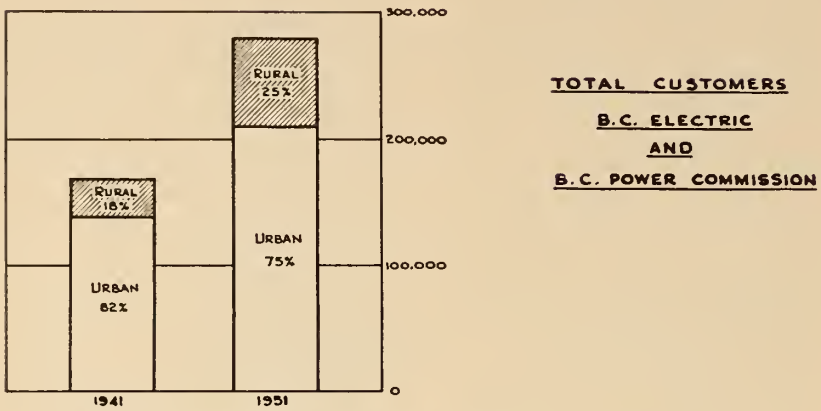


Fig. 3. The urban and rural customers of B.C. Electric and the B.C. Power Commission.

The average monthly bill was still exactly $5.00, but the customer received three times as much energy for his money.

Another representative community is Terrace, a village at present in the news because of its proximity to the Alcan development at Kitimat. Here there were only 59 premises with electric service in 1945. Now there are 650. Whereas the residential customers of that village once used 26 kwh. in a month each and paid 16.7c per kwh., each now uses 148 kwh. each month and pays 3.8c per kwh.; the product costs less than one quarter as much as before.

These villages exemplify true rural electrification. Customer growth represents not only influx of people, but gradual extension of distribution to outlying areas, made possible by increasing volume of business and the application of average costs. Growth of per-customer consumption represents improvement in living conditions, and this at vastly reduced unit cost.

The British Columbia Electric Company reports sharp increases in rural consumption. In 1941 the residential customers of the Fraser Valley, Richmond, Fraser Canyon and Bridge River areas used an average of 711 kilowatt hours annually. In 1951 they used 1,930 kilowatt hours. Their average unit cost was reduced from 3.2c in 1941 to 2.4c in 1951. Thus the usage of this large group increased 270 per cent during the decade, whereas unit cost decreased by 25 per cent.

It should be emphasized that results of this type have been achieved by combining the large with the small, the remote with the accessible, the fat with the lean, to produce an average operating position which is financially sound.

Self-Sustaining Distribution Systems

The capital investments required in the expansion of the Commission's power districts have been made on a self-sustaining basis. A district purchases its power wholesale at the rate established for the whole operation and must gain sufficient revenue from distribution to meet all costs. Of the 19 small power districts set up and now under the Commission's operation, only four have been unable to show a surplus after all charges have been met. Two of these have had only two to three years' operation.

There have been no financial grants in aid of electrification, although the Electric Power Act provides for such assistance. All expansion of plant has proved self-sustaining; this has been achieved by careful consideration of the economics of proposed extensions and the setting of appropriate minimum charges for service, together with the internal subsidy provided by the pooling of generation and transmission costs. The application of average costs to an ever-widening field and an ever-increasing volume of business has also worked to the advantage of rural expansion.

Extension of Accessible Areas

Extension of existing facilities to unserved areas comprised the third phase of the province's problem. It appeared that 10,000 potential customers who were unserved at that time, could be taken into the operations of certain of the larger utilities without appreciably affecting the position of urban users.

The survey of 1943 found approximately 3,400 rural premises in the Lower Mainland area which could obtain service by the extension of existing plant. The British Columbia Electric Company Limited reports an increase from 1941 to 1951 in customers served in this area of over 25,000. To serve these new customers the Company constructed approximately 600 miles of rural line and converted many existing circuits to 6.9/12 kv.

The Company's extension policy was, in 1942, based on a revenue guarantee. The customer guaranteed a monthly revenue which in four years covered the cost of the extension. Having met this guarantee the customer received service at the standard monthly minimum charge. A similar plan is still in effect, and after consideration has been given to the number of potential additional customers which can be expected on any extension, the majority of new customers have a minimum bill of $2.00 for the initial four-year period, after which they pay the standard minimums. The Company has no minimum density restriction; it therefore considers its rural extensions upon the combined factors of potential growth and a four-year minimum bill.

According to the 1943 survey, there were approximately 1,100 premises awaiting service from existing lines in the North Okanagan area. Since acquiring this territory in 1945 the Power Commission has added nearly 4,000 services and built approximately 500 miles of distribution line.

Electrification of this district was carried out in blocks. Several areas were set up, the necessary minimum charges established for each area and a committee of local residents formed within it. This committee saw that all prospective customers within its territory understood the requirements as to minimums and that they proceeded with the wiring of premises. It also maintained liaison with the utility; priorities of construction were set up and each project was completed in its turn. All prospective customers were made aware of the approximate date when service would be available, so the utility was spared the construction of plant before customers were ready.

The Commission's extension policy is to call for a minimum monthly guarantee which will meet the carrying charges on the investment in required distribution plant. Because carrying charges do not terminate, the minimum bill set by them has no time limit. It can be reduced only by the addition of more customers served by the same plant and is reviewed periodically on that basis. As the minimum bill is not a service charge, it is readily accepted.

The only other area cited by the 1943 survey as requiring major extension to existing facilities was the South Okanagan, where 1,700 customers awaited service. This area is served by the West Kootenay Power & Light Company. Figures as to electrification here since the survey are not available, but it is reasonable to assume that the majority of these potential customers are now served.

The remaining 3,800 possible customers, as of 1943, who could reasonably expect service by extension of existing facilities, were widely spread over the province and now are receiving service.

Thus, approximately 33,000 rural premises have been added to existing systems during the past decade, rather than the 10,000 envisaged in 1943.

Service to Remote Areas

The fourth aspect of the province's rural electrification problem was the consideration of communities and areas which were so remote and so sparsely populated as to be without electric service. Individuals and organizations present petitions for electric service with admirable regularity.

There is little danger of any areas being overlooked in the surveys, which are almost continuous. Since 1945 at least 40 communities and areas have received detailed attention. These surveys have led to the electrification of at least 20 areas, most of which started operation with 50 to 100 customers. Diesel stations have been constructed to serve the more remote communities, others have been reached by submarine cable or by substations on new transmission lines.

The feasibility of providing service in remote and hitherto unserved areas is determined, in the operations of the Power Commission, by economics. The area under consideration must, if it is to be electrified, show promise of being able to pay for its purchased power at the undertaking's averaged cost and to meet all distribution plant operating and carrying charges within a reasonable time. No specific density of customers is called for; the minimum feasible density is automatically set by the local geographic conditions, the number of potential customers, the prevailing costs of construction and the amount of the minimum monthly bill which the community can pay.

Minimum monthly charges in such areas are determined by consideration of the required capital investment in distribution plant, and service contracts must be executed before work is authorized. Boards of Trade and Farmers' Institutes are frequently of considerable assistance in the completion of such arrangements, and on occasion have rendered valuable assistance in supplying labour and poles.

There is no visible termination to the problem of the small community. As one area develops so that service can be rendered on an economic basis, another commences its campaign for electrification.

Financing

The investing public has demonstrated an appreciation of British Columbia's potentialities, an awareness of the province's rapid development and confidence in the future. These facts are demonstrated by the ease with which both the British Columbia Electric Company and the Power Commission have been able to borrow their capital requirements. In the past six years the Company has raised $130 million of new money; the Power Commission has borrowed $50 millions since 1945.

Repayment of borrowings must be made from revenue by utilities, regardless of any definition of ownership. That expansion into the less profitable rural areas has not been carried too far is evident from the fact that earnings are adequate; it is interesting to note that while a deficit was anticipated during the first few years of the Power Commission's operations, it never materialized. The rural areas have thus far been able to contribute enough to maintain their solvency and to justify the cost of serving them.

British Columbia's utilities are watching their capital expenditure on rural electrification with care, in order that balance may be maintained and the confidence of the investing public be retained. They are, at the same time, encouraging the continued development of the more remote areas by offering rates which permit load growth and by continuing construction programs to the economic limit.

Results of Rural Electrification

The results of British Columbia's rural electrification during the past decade appear in two sets of figures; first, in the increase in the actual number of rural customers and second, in the increase in consumption and in the reduction of unit cost.

Complete figures as to customers in the province are not available for any date later than 1943. They are available, however, for the Company and for the Power Commission, and as the areas now served by these two utilities represented 82 per cent of the total customers in 1943 their figures may be used for comparison.

At the start of the decade, the Company served approximately 148,000 customers on the Lower Mainland and southern Vancouver Island. Of these 21,000 or 14 per cent were rural. The areas later served by the Power Commission contained approximately 22,000 customers, of whom an estimated 40 per cent or 9,000, were rural. The two utilities combined served 170,000 customers, of whom 30,000, or approximately 18 per cent, were rural.

In 1951 the figures were as follows: The Company had approximately 235,000 customers, of whom 50,000, or 21 per cent, were rural. The Power Commission had approximately 45,000 customers, of whom 49 per cent, or 22,000, were rural. Totals for the two utilities were 280,000 customers, of whom 72,000, or 25 per cent, were rural. These results are summarized in Figure 3, from which it appears that rural electrification has increased by 140 per cent during the decade.

Figures to show changes in the consumption of energy by rural customers are not available for the province as a whole. The following, however, show the increased usage and reduced unit cost for the 19 rural power districts served by the Power Commission:

Rural Residential Customers, Average Use

Year	Kwh/month	Cost/Kwh
1946	31	10.2c
1947	53	7.4
1948	69	5.7
1949	84	4.9
1950	97	4.4
1951	123	4.0

Cost of Rural Electrification

The annual reports of the Power Commission set forth the actual plant investment in each power district. Similar figures are not avail-

able for other utilities in the province. Considering distribution plant only, excluding customers' meters, the following figures apply:

	Customers per mile	Distribution per mile	Plant Costs per customer
Rural Districts (fewer than 1,200 customers)	18.0	$4,050	$225
All Districts	18.5	$3,700	$200

Rural districts of fewer than 1,200 customers average 500 customers each. The predominantly rural character of the Commission's operations is shown by the overall figure of 18.5 customers per mile.

The figure given for distribution plant costs includes all distribution plant of all ages. The more recent construction is showing a cost per mile which is considerably higher. Some costs of individual jobs follow:

Year Built	Voltage	Miles of Rural Line	Cost per Mile
1949	6.9/12 Kv.	39.9	$4,460
1949	6.9/12 Kv.	3.4	7,450
1949	2.3 Kv.	10.9	5,240
1950	6.9/12 Kv.	12.6	5,360
1951	6.9/12 Kv.	34.5	3,280

The wide variations in cost per mile are caused by geography and topography.

The overall investment of the B.C. Power Commission in all types of plant was $36,116,000, at March 31, 1951. There were 44,000 customers then served. The total investment per customer was therefore $820. As nearly half this utility's customers is rural, the figure of $820 is perhaps representative of the order of cost involved in providing rural electrification in British Columbia. That the investment is not excessive is demonstrated by the facts that the utility generated 96 per cent of its energy and had, in six years' operation set up reserves for sinking fund, maintenance and renewals of 6.7 per cent of its capital investment, in addition to a stabilization reserve equal to 2.7 per cent of total investment.

Technical Aspects of Rural Construction

Technically the rural electrification of the province offers but little of interest to the distribution engineer.

With the exception of the plain of the lower Fraser Valley and some of the arable areas of the interior, the terrain of the province is such as to call for comparatively costly line construction. Plant is placed mainly on the public right-of-way which, because of the rough terrain, frequently involves many corners and short spans. The proportion of rock to earth post holes is high. Particularly on the coast, clearing costs assume large proportions and one problem of the distribution engineer is to strike a balance between cost of completely removing timber and brush and cost of operating difficulties arising from incomplete clearing. Maintenance costs are increased by the rapid rate of regrowth.

The British Columbia Electric Company has standardized on 6.9/12 kv. construction for rural lines, using 40- and 45-foot poles. On the coast both the Company and the Commission use treated poles. The Commission applies osmo-creo treatment at the ground line only, and to date has used Western red cedar poles exclusively. In the interior some recent design has called for jack pine poles.

The minimum capacity of distribution transformers now being purchased is 3 kva., with consideration being given to increasing it to 5 kva. Neither utility provides any lightning protection for distribution transformers except in large banks. Experience in transformer damage caused by lightning has shown protection to be unwarranted.

A limited amount of submarine cable has been used in rural electrification, mainly to cross lakes or reach islands. An interesting example is the three-phase grounded delta cable laid by the Company to serve Bowen Island.

A number of ground-return telephone circuits still exist in the province. Where it is necessary to parallel such circuits with single-phase 6.9/12 kv. power lines, a metallic telephone return must be installed. Agreement has been reached with the telephone companies as to the sharing of costs. Where overbuild is necessary at this voltage, protectors are installed on the telephone circuits at half-mile intervals.

Conclusion

Extensive and rapid progress has been made in the electrification of the province's rural areas during the 1942-1952 decade as shown by the increase in customers and in the augmented use being made of the service. Rates, while promoting increased consumption, are such as to provide return adequate to carry the cost of service. The application of averaged costs over ever widening areas is contributing to the continuing expansion of service, while maintaining investment per customer at a reasonable level. Expansion of service in the rural areas of British Columbia will continue to the limit of economic feasibility.

Notes on Utilities in British Columbia

In 1943 there were 65 separate organizations engaged in providing central station service in the province. Four large utilities, 33 small utilities, 19 municipalities and 21 primary industries or institutions were engaged in distribution. The large utilities were:

British Columbia Electric Company Ltd.: Vancouver City, Fraser Valley, Victoria and vicinity, Alberni, Kamloops, Qualicum, Royston.

West Kootenay Power & Light Company: South Okanagan, Rossland, Trail.

Nanaimo-Duncan Utilities, Ltd.: Vancouver Island Centre, including Nanaimo and Duncan.

West Canadian Hydro Electric Corporation, Ltd.: North Okanagan, including Vernon.

In 1945 the British Columbia Power Commission was created under the Electric Power Act. The Commission acquired by expropriation the properties of the West Canadian Hydro Electric Corporation and its associated companies, the Nanaimo-Duncan Utilities and the Columbia Power Company. Later acquisitions included Kamloops, Alberni, small areas on Vancouver Island, and numerous small systems throughout the Province, including certain municipally-owned systems.

Areas of service are now consolidated as follows:—

British Columbia Electric Company, Ltd.: Greater Vancouver, Fraser Valley to Hope, Lytton, Lillooet, Bridge River; east side of Howe Sound; Greater Victoria and southern Vancouver Island.

British Columbia Power Commission: Central and northern Vancouver Island, including Alberni, Tofino and Alert Bay; North Okanagan and Kamloops; Sechelt Peninsula; Burns Lake, Hazelton, Houston, Smithers, Terrace, Vanderhoof and Dawson Creek in northern British Columbia; Williams Lake, Clinton and Quesnel in the Cariboo; Golden, Lake Windermere, Merritt and Nakusp. Fort St. James and Queen Charlotte are to be added in 1952.

West Kootenay Power & Light Company: South Okanagan, Trail, Rossland and vicinity.

19 of the 33 smaller utilities, operating in 23 areas, four of the 19 municipalities and two of the 21 primary industry systems are now consolidated in the three larger utilities listed above. √

FROM MONTH TO MONTH

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

"Back to Using Canadian Engineers"

Over many years *The Engineering Journal* has been critical of the too common practice of employing United States engineers for work in Canada which could be done at least as well by Canadians. It is bad enough when United States organizations building in Canada use exclusively their own engineers, but it is inexcusable in most cases for Canadians to engage foreign consultants. It is bad enough when industry shows in this way its lack of confidence in Canadians, but it is worse when government does it. Government at many levels has shown a lack of knowledge of Canadian engineers' capacities and has built up a long, shameful record of cases where apparently they thought Canadians were not good enough.

In keeping with this spirit a startling statement was made recently in the House of Commons at Ottawa by the Honourable Mr. Gardiner, Minister of Agriculture, during a discussion of the study of the South Saskatchewan River. A three-man commission was appointed several months ago to carry out this study. On this are two of Canada's most outstanding civil engineers, the third member, an agriculturist, being from the United States.

On June 28th Mr. Gardiner was being questioned about the commission, particularly from the point of view of progress or the lack thereof, and the personnel of the commission. He went to great length to explain the complications and to emphasize the difficulties of the work. In the process he did a very poor job as far as Canadian engineers were concerned.

Mr. Gardiner declares his lack of confidence in Canadian engineers generally, something which he has done on previous occasions as well. He says: "But we were not satisfied to rely upon these men (Canadians), and so we went down to the United States and got three of the best engineers that are known."

In this statement Mr. Gardiner proves that he has a better knowledge of things in the United States than he has in Canada, for the two Canadian engineers on the commission are much better known to most Canadians than are any of the three he refers to in the United States.

One does not ordinarily associate an inferiority complex with Mr. Gardiner, but from his own statement it is fair to conclude that he believes something from the States must be better than something from Canada. This is the inferiority complex that bedevils so much of the thinking in Canada.

Canadian engineers will not be pleased with Mr. Gardiner's apologies for having had to engage Canadians because the supermen he approached in the States "all turned it down". Thus apologetically he explains "so eventually we got back to using Canadian engineers". Here are two paragraphs from Hansard.

"It has been said that we ought to have a different type of men on the commission. I would just like to say that men are not as easily got at the present time as they were some years ago. Some people wondered why it took us so long to get the commission set up. We tried to get—and when I say 'we' I mean the government did—four of the top-notch engineers in the United States and, one at a time, offered to appoint them. The first of those who were recommended did not find it possible to take it on. Then when that one did not find it possible to do it, he recommended still another one, until we had been in touch with the four of them.

"It took some considerable time to give these men the opportunity to determine whether or not they would take the position. Finally they all turned it down. They said they had other work which was taking up all their time, and for that reason they could not take on this work. So eventually we got back to using Canadian engineers, in so far as the power end of it was concerned. So we have two men."

What can anyone do to impress people in high places that Canadian

Cover Picture

Two power feed drifter drills on hydraulic booms in operation on the face of power tunnel No. 1 of the Nechako-Kemano-Kitimat hydro-electric power development. They are mounted on the upper deck of the jumbo (see photo page 924) on the 2,600-foot level.

—*Photo courtesy Aluminum Company of Canada, Ltd.*

professional people are as competent as any in the world? For work in Canada they are not only just as competent, but they are the most competent. There are many instances of work done in Canada to prove it as far as engineers are concerned, and yet here we have a case of a Minister of the Crown trying his best not to engage Canadians. What an indignity it would have been to have had a commission made up completely of Americans to study the South Saskatchewan River possibilities! There are many engineers in Canada more competent to do this work than would be any strangers whose foreign addresses would seem to dazzle the eyes of those who make the decisions.

For goodness sake let's be sensible, let's be logical, let's be Canadian!

Engineers in Canada

Editor's Note—The following information was presented to the Branch Officers Conference of the Institute held in Vancouver on May 6th, 1952. Attention is called particularly to the challenge contained in the concluding paragraph and to the charts which give graphic support to the observations and suggestions of Dr. Massue.

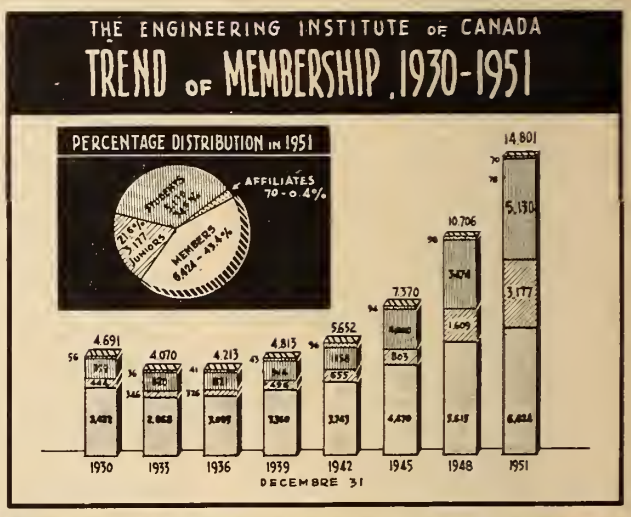
Salient Facts of the Analysis

Dr. Huet Massue, M.E.I.C.*

1. The Engineering Institute of Canada is the leading engineering society in Canada. It recruits its membership in all fields of engineering and from all parts of the country. Administered by a council of 66 members, it now serves 14,805 members through 37 branches scattered from the Atlantic to the Pacific.
2. On December 31, 1951, the 6 branches in Quebec had 4,725 members; the 15 branches of Ontario 4,593; the 5 branches of the Prairies 2,196; the 7 branches of the Maritimes 1,480; and the 4 branches in British Columbia 1,255. The 6,424 corporate members represented 43.3 per cent of the total membership, the 3,177 juniors 21.5 per cent, and the 5,130 students 34.7 per cent.
3. The Montreal Branch, with 3,655 members, including 1,308 students, is by far the largest branch. It has twice as many members as the Toronto Branch (1,544) and four times as many members as the Vancouver Branch (984). Ottawa has 853 members, Quebec 488, Victoria 188, and Trail 58.
4. The total membership, at 14,805 at the end of 1951, represented an all-time peak. It was twice that of six years ago, at the end of World War II. Corporate membership, at 6,424, was 145

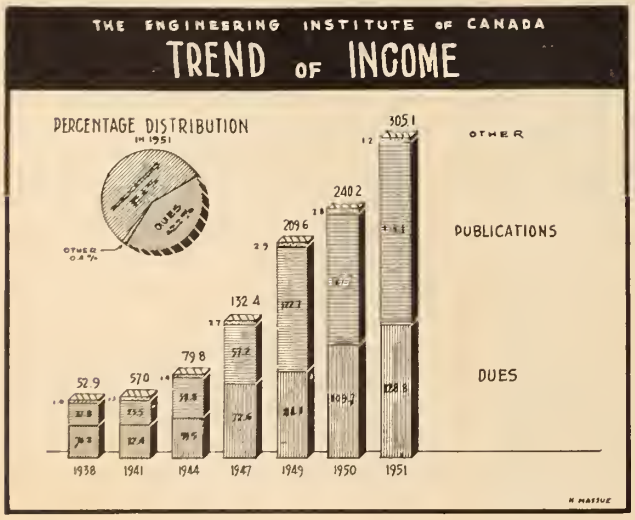
*Manager, Economics and Statistics Department, Shawinigan Water and Power Company, Montreal.

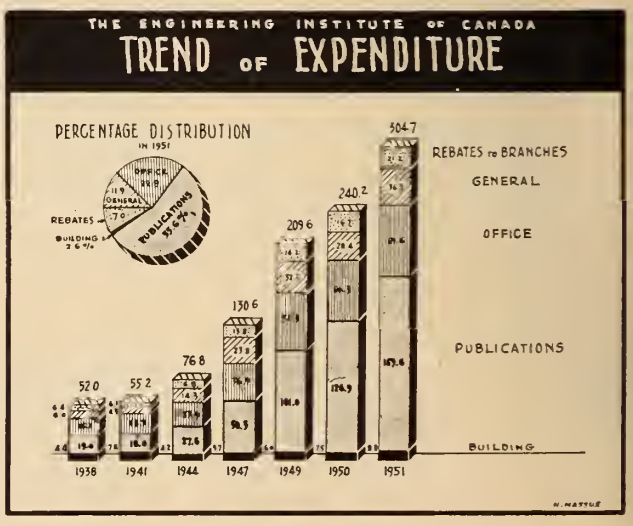
Membership in the Engineering Institute at the end of 1951 was at an all-time high. The trend since 1930 is shown in the figure at right.



In 1951 expenditures of the Institute totalled $304,700, as shown in the figure at lower right. This was 590 per cent of the 1938 expenditures.

A record total income of $305,000 was shown for 1951, as indicated in the figure below. It was nearly six times the income for 1938.

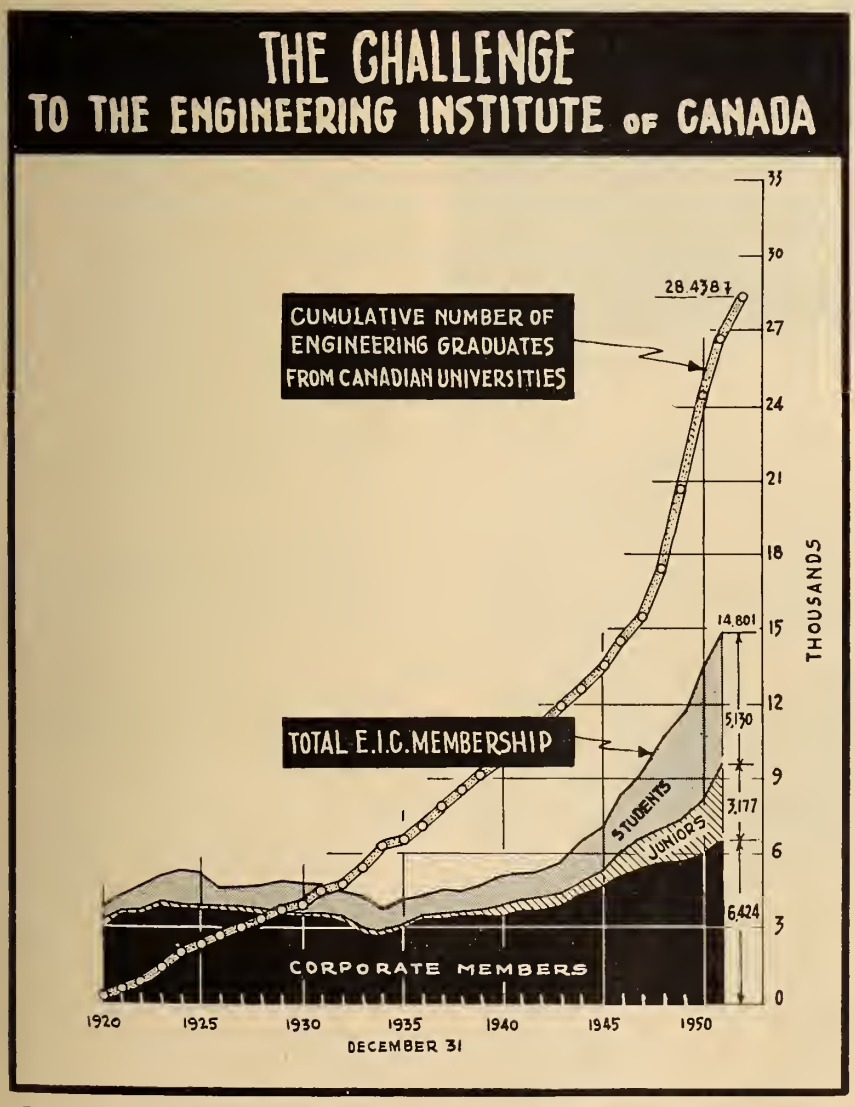




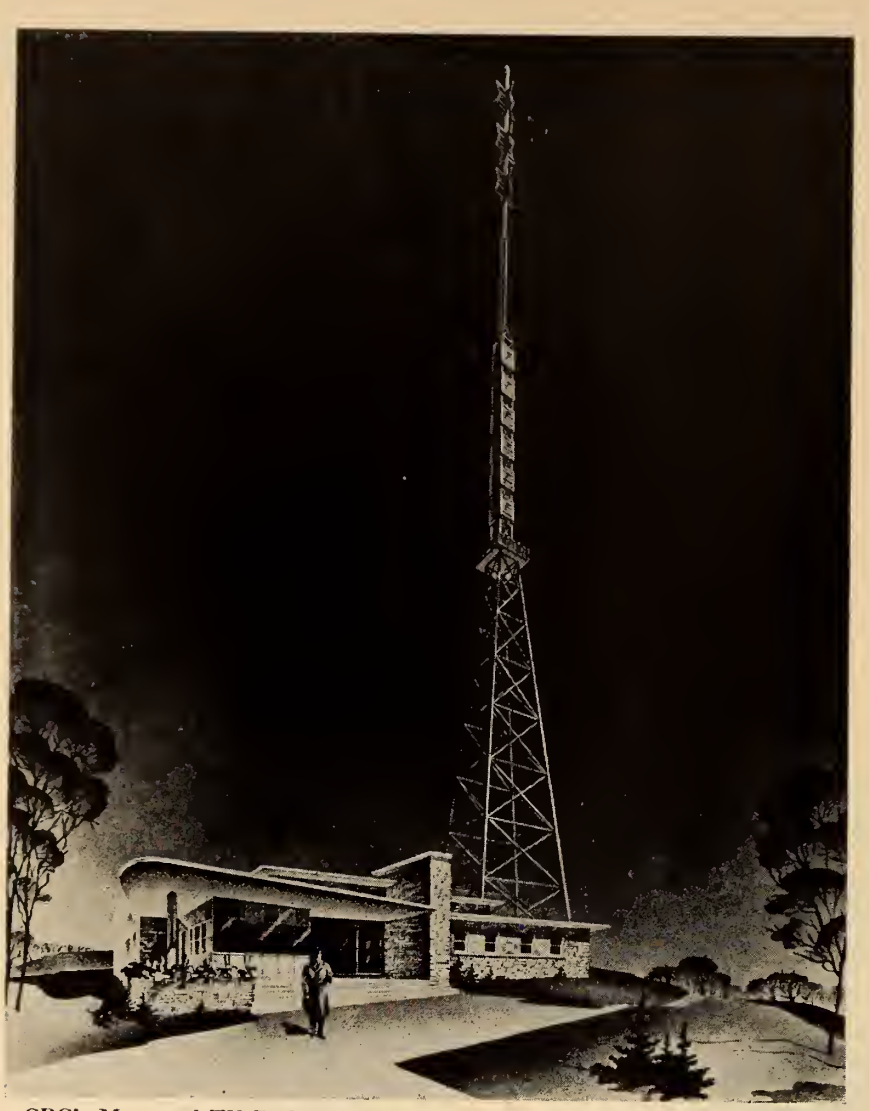
per cent as large, Junior membership at 3,177 nearly 400 per cent, and Student membership at 5,130, 256 per cent.

5. The last ten years saw the total membership of the Institute grow from 5,292 to 14,805, or by 180 per cent. By regions the increase was as follows: British Columbia 380 per cent; the Prairies 160 per cent; Ontario 170 per cent; Quebec 175 per cent, and the Maritimes 210 per cent. The large increase in Junior membership during the last few years should accelerate in the near future the growth in Corporate membership.
6. The growth of Corporate and Junior membership amounted to 126 per cent between 1941 and 1951, and to 13.5 per cent in 1951. For the last ten years, the growth was the highest in Edmonton and the lowest in Peterborough and Ottawa.
7. In 1951 the income of the Institute reached an all-time peak of $305,000; 42.2 per cent of this amount came from dues and 57.4 per cent from publications. The 1951 income was 130 per cent higher than that of 1947 and was nearly six times as high as that of 1938.
8. In 1951 the expenditures of the Institute reached $304,700. Publications absorbed 55.6 per cent of the income, office expenses 22.9 per cent, general expenses 11.9 per cent, rebates to branches 7.0 per cent, and maintenance of buildings 2.6 per cent. The 1951 expenditures were 230 per cent those of 1947 and 590 per cent those of 1938.
9. The Institute branches finance their operations through rebates received from headquarters and through contributions received from their own members. In 1951, the Cape Breton branch led all branches with an average expenditure by member of $14.80, the Sherbrooke branch which started operations late in the year spent 55c.
10. Registration in Engineering, at the 11 Canadian faculties, reached an all-time peak of 14,149 in 1947, when 8,883 veterans enrolled. Pre-World War II registration was of the order of 4,000; present registration amounts to 7,500. Pre-war graduating class numbered about 800; they now count 1,720 students.
11. In 1946, first-year registrations reached an all-time peak of 6,140, of which 4,496 were veterans. First-year registrations dropped to 1,794 in 1950 and then increased to 2,105 in 1951.
12. Between 1941 and 1952, Canadian universities contributed a total of 18,979 graduates. The University of Toronto contributed 5,524, the Prairie provinces contributed 4,076, and the French universities 1,023.
13. Since 1920 a total of 29,082 engineers graduated from Canadian universities. 24.3 per cent of the graduates took civil engineering, 22.8 per cent electrical, 20 per cent mechanical, and 14.1 per cent chemical. The present graduating class contains 529 civil engineers, 339 electrical engineers, 336 mechanical engineers, 212 chemical engineers, and only 60 mining engineers.
14. In 1951, there were approximately 35,000 engineers in Canada; there were twice as many as 20 years ago and more than 12 times as many as in 1901.
15. Whereas in 1901 there were in Canada 2,100 people per engineer, in 1921 the number had decreased to 680, and in 1951 to approximately 400.
16. At the end of 1951, the associations of Professional Engineers in Canada counted 17,000 members. There were 9,443 in Ontario, 4,298 in Quebec, 1,334 in the Prairies, 1,239 in British Columbia, and 676 in the Maritimes. It is of interest that during the last five years the number of registered engineers in Canada increased by 50 per cent.
17. In November, 1951, *The Engineering Journal* counted 12,500 paid subscribers, 4,010 to be found in Quebec and 3,938 in Ontario. Amongst the subscribers, all the main industries were well represented.
18. Between 1920 and 1952 there graduated from Canadian uni-

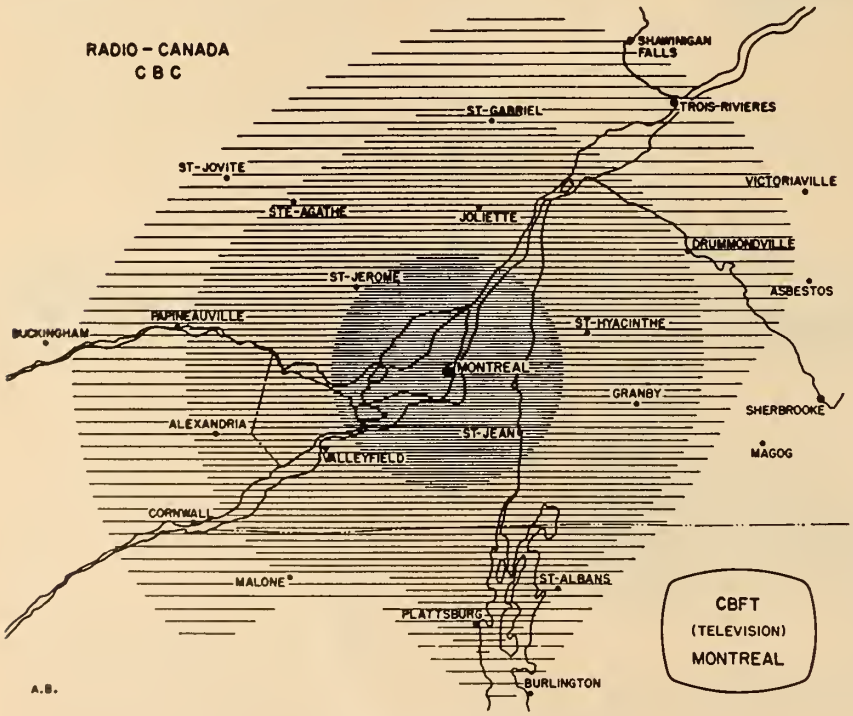
(*Continued on next page*)



In the last 30 years a total of 28,438 engineers graduated from Canadian universities. In the last 15 years 20,000 graduated and the Institute's membership increased by 10,000.



CBC's Montreal TV-Radio tower as it will appear when erected in 1953.



Areas of excellent, good and fair reception of television from CBFT, Montreal.

CBC Transmission Tower

When regular television transmission began from station CBFT in Montreal early this month, a temporary 70-foot tower on the summit of Mount Royal was used. But eventually, when steel becomes available, a 283-foot tower will be erected. This self-supporting tower is shown in the drawing at left.

This permanent tower, which will probably be erected early in 1953, will be equipped to do five jobs. It will carry the antenna for CBFT, for CBF-FM and CBM-FM, and will have space for the antenna of CBC's projected second Montreal TV station. In addition, at the 150-foot level, microwave receiving antennae or "dishes" will be located for reception of programs from the TV mobile unit.

The site on Mount Royal is 744 feet above sea level and the antenna will be 912 feet above the average terrain within 10 miles of the mountain.

The permanent tower must be self-supporting for CBC was granted too small an area on the mountain to allow installation of guy wires.

Immediately above the platform at 129 feet is a six-bay super-gain antenna for use on channel six at some future date. Above this antenna, in the middle section, are two pylon antennae for two-frequency modulation. These are for the two CBC-FM stations now operating in Montreal. The top, three-bay super-turnstile antenna is for channel two, television.

The map gives an approximate indication of the expected coverage of CBFT when the permanent tower is erected.

The shading shows areas of excellent, good and fair reception.

The transmitter equipment is housed in a low, chalet-style building of Deschambault stone designed to fit in with its park-like surroundings. This equipment is linked to the studios in CBC's Radio-Canada Building, 1.6 miles away, by underground cable.

(*Continued from page 953*)

versities a total of 28,438 engineers, 20,000 of them in the last 15 years. During that time the Institute membership increased by 10,000, comprising 3,138 Corporate members, 2,681 Juniors, and 4,324 Students. The opportunity for strengthening the Institute membership and for increasing the value of the Institute to each member has never been so great. Let it be a challenge!

News of Other Societies

The **Canadian Electrical Association** (Room 704, Tramways Building, Montreal 1) has scheduled future meetings as follows: Annual conventions, 1953, June 24-27, Murray Bay, Que.; 1954, June 23-26, Murray Bay, Que.; 1955 (tentative) June 20-25, Banff, Alta.

Meetings of the Engineering Division of C.E.A. in 1953 are as follows: January 19-20, Maritime Provinces, and February 23-25, Calgary; Sales Division: January 26-27, Niagara Falls, Ont., and March 2-3, Edmonton, Alta.; General meeting: February 2-3, Quebec Province.

The annual convention of the **Canadian Good Roads Association** (270 MacLaren St., Ottawa) will take place at Quebec City, October 20-23, 1952.

The **Chemical Institute of Canada** has scheduled the Western Regional Conference to be held in Saskatoon, Sask., October 24-25, 1952.

Dr. A. B. Van Cleave, University of Saskatchewan, Saskatoon, is secretary of the organizing committee.

A conference on machine tools, will take place at the Ten Eyck Hotel, Albany, N.Y., October 29-31, under the auspices of the **American Institute of Electrical Engineers** (33 West 39th St., New York City).

The 1953 annual meeting of **The Engineers' Council for Professional Development** will be held in New York on October 30th and 31st, 1953.

On the calendar of the **Society of the Plastics Industry, Inc.** (67 West 44th Street, New York 36, N.Y.), are: the S.P.I. New England Section Meeting, at Equinox House, Manchester, Vermont, October 16-17; and the fourth S.P.I. film, sheeting and coated fabrics division conference, December 4-5, Commodore Hotel, New York City.

The Federation of Sewage and Industrial Wastes Associations (325 Illinois Building, Champaign, Illinois), has announced that the 25th anniversary meeting will take place at the Hotel Statler in New York City, October 6-9, 1952.

The Air Pollution and Smoke Prevention Association of America (4400 Fifth Avenue, Pittsburgh, 13, Pa.), has announced the change of its name to **Air Pollution Control Association.**

The **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) has available information on plans for the annual meeting, to be held at the Hotel Statler, New York City, November 30 to Dec. 5, 1952.

On the program for December 2, is a symposium on extremely large forgings and extrusions, organized jointly by A.S.M.E., the American Institute of Mining and Metallurgical Engineers, the Institute of Aeronautical Sciences, and the Society of Automotive Engineers.

The 40th annual National Safety Congress is announced by the **National Safety Council** (425 North Michigan Avenue, Chicago 11, Ill.). Five hotels in Chicago are to accommodate those in attendance at the meeting October 20 to 24, and information can be obtained from the National Safety Council.

The biennial Congress and Exhibition of Public Works and Municipal Services (68 Victoria St., London, S.W.1) jointly organized at Olympia, London, by the Congress Organizing Council and the Municipal Agency, will take place November 3-8, 1952.

Discussion of up-to-date questions affecting every urban and rural community is planned, and the exhibition will embrace equipment of every kind.

At the annual general meeting of the **British Standards Institution** (24 Victoria Street, London, S.W.16) held on Wednesday, July 23, it was announced that the general council had elected Mr. John Ryan, C.B.E., M.E., as its chairman to succeed Sir Roger Duncalfe, who had completed his three-year term of office.

In the course of the meeting, the Rt. Hon. Viscount Waverley, P.C., G.C.B., G.C.S.I., G.C.I.E., F.R.S., was re-elected president of the Institution for the third year. Sir Roger Duncalfe was elected vice-president.

The Institute of Metals (4 Grosvenor Gardens, London, S.W. 1) has announced a Symposium on Properties of Metallic Surfaces, to take place in London, November 19, 1952.

Members of The Engineering Institute of Canada are invited to attend. They are asked to indicate their interest by writing either to E.I.C. Headquarters or to the Secretary of the Institute of Metals, Lieut.-Col. S. C. Guillan, whose letter to Headquarters is printed herewith:

A symposium on "Properties of Metallic Surfaces", organized by the Institute of Metals, will be held in the Lecture Theatre of the Royal Institution of Great Britain, Albemarle Street, London, W.1, on Wednesday, 19 November 1952. There will be two sessions on that day: (i) 9.45 a.m. to 12.15 p.m., and (ii) 2.00 p.m. to 5.00 p.m.

A cordial invitation is issued to your members to participate in this meeting, which it is expected will be attended by many scientists from all parts of the world. Any persons who desire to attend should apply for a programme and Registration Form, to The Secretary, The Institute of Metals, 4 Grosvenor Gardens, London, S.W.1. The programme will be available in August. The registration fee of 5s. will entitle participants to a set of advance copies of the papers, to enable them to take part in the discussion.

All the papers, together with a report of the discussion, will subseqently be published (clothbound) as Institute of Metals Monograph No. 13—"Properties of Metallic Surfaces". As the number of advance copies of papers will be limited, it is particularly requested that only those who intend to be present at the meeting shall apply for them.

The papers contributed to the Symposium are as follows, and will be discussed at sessions as detailed below. At the meeting, papers will be summarized by rapporteurs; they will not be separately presented. No additional papers can be accepted.

Session I

(19 November, 9.45 a.m.-12.15 p.m.)

(1) "Specialized Microscopical Techniques in Metallurgy", by Professor S. Tolansky, F.R.S. (Royal Holloway College, University of London).

(2) "Radioisotopes in the Study

of Metal Surface Reactions in Solutions", by Dr. M. T. Simnad (Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa., U.S.A.).

(3) "The Crystalline Character of Abraded Surfaces", by Dr. P. Gay and Dr. P. B. Hirsch (Cavendish Laboratory, Cambridge).

(4) "Diffusion Coatings", by Mr. D. M. Dovey, Dr. I. Jenkins and Mr. K. C. Randle (Research Laboratories, The General Electric Co., Ltd., Wembley).

(5) "The Nature and Properties of the Anodic Film on Aluminium and its Alloys", by Mr. H. W. L. Phillips (Research Laboratories, The British Aluminium Co., Ltd., Gerrards Cross).

(6) "Chemical Behaviour as Influenced by Surface Condition", by Dr. U. R. Evans, F.R.S. (Cambridge University).

(7) "The Effect of Method of Preparation on the High-Frequency Surface Resistance of Metals", by Dr. R. G. Chambers and Dr. A. B. Pippard (Royal Society Mond Laboratory, Cambridge).

Session II

(19 November, 2.00 p.m. to 5.00 p.m.)

(1) "The Influence of Machining and Grinding Methods on the Mechanical and Physical Condition of Metal Surfaces", by Mr. P. Spear, Mr. I. R. Robinson and Mr. K. J. B. Wolfe (The B.S.A. Group Machinability Laboratory, B.S.A. Tools, Ltd., Birmingham).

(2) "The Effect of Lubrication and Nature of Superficial Layer After Prolonged Periods of Running", by Dr. F. T. Barwell (Lubrication Division, Mechanical Engineering Research Organization, Department of Scientific and Industrial Research, Glasgow).

(3) "The Effect of Surface Conditions on the Mechanical Properties of Metals, Mainly Single Crystals", by Professor E. N. da C. Andrade, F.R.S. (Royal Institution, London).

(4) "The Effect of Surface Condition on the Strength of Brittle Materials", by Professor C. Gurney (University College, Cardiff (University of Wales)).

(5) "The Influence of Surface Condition on the Fatigue Strength of Steel", by Mr. R. J. Love (Motor Industry Research Association, Brentford).

(6) "The Influence of Surface Films on the Friction and Deformation of Surfaces", by Dr. F. P. Bowden and Dr. D. Tabor (Cambridge University).

Personals

News of the Personal Activities of Members of the Institute

P. L. Kuhring, M.E.I.C., assistant chief engineer for the River St. Lawrence Ship Channel, with the Department of Transport, has been elected president of the Canadian Authors' Association.

Mr. Kuhring joined the Department of Marine at Ottawa in 1913. From 1916 to 1919 he was on military service in Canada and overseas and in 1916 he was loaned to the River St. Lawrence Ship Channel as a junior engineer.

He is a member of the Professional Institute of the Civil Service of Canada.

M. W. Turner, M.E.I.C., of Winnipeg, Manitoba, has recently retired from the position of resident engineer of the Manitoba Paper Company Limited.

Mr. Turner was born in Kansas, U.S.A., and graduated as a civil engineer from Cornell University in 1911. After graduation, he worked with the Canadian Pacific Railway on maintenance-of-way until 1915, when he went to Canadian Explosives Limited at Nobel, Ont., on construction work and mechanical repairs.

Later he worked for 3 years as assistant engineer in charge of construction of a pulp and paper mill for the Management Engineering and Development Company at Dayton, Ohio, and with the Fort William Paper Company Limited. In 1928 he joined the Manitoba Paper Co. Ltd. as chief engineer at Pine Falls, Man.

J. M. Campbell, M.E.I.C., has recently retired from the position of division engineer with the Canadian Pacific Railway at Lethbridge, Alberta.

Mr. Campbell was born and educated in Dumfermline, Scotland. He joined the C.P.R. at Souris, Man., in 1907 and became resident engineer at Kenora, Ont., in 1913. During World War I he served overseas with the Canadian armed forces from 1915 to 1919. He returned to the C.P.R. at Dryden, Ont., in 1919 and was appointed division engineer at Winnipeg in 1920.

T. H. Jenkins, M.E.I.C., has been appointed engineer of bridges and construction of Canadian National Railways Mr. Jenkins was born at Toronto and graduated in civil engineering from the University of Toronto. He began his career as a draughtsman for the Canadian National Railways at Detroit in 1926, becoming bridge engineer later for the central region, at Toronto. In 1951 he was appointed engineer of bridges for the system.

Dr. Huet Massue, M.E.I.C., engineer-economist of the Shawinigan Water and Power Company and a director of Atomic Energy of Canada Limited has been appointed manager of Shawinigan's newly-established economics and statistics department. This department will compile and co-ordinate the company's statistics and will carry out economic studies affecting Shawinigan's operations.

Dr. Huet Massue, M.E.I.C.

Dr. Massue is a graduate of Ecole Polytechnique, Montreal, and of Massachusetts Institute of Technology and received the honorary degree of doctor of applied science from the University of Montreal in 1947.

Paul Dilworth, M.E.I.C., chief engineer of the gas turbine division of A. V. Roe Canada Limited at Malton. Ont., recently resigned from this position.

Mr. Dilworth graduated from the University of Toronto, obtaining a B.Sc. degree in mechanical engineering in 1939. He was a research engineer in the engine laboratory at the National Research Council until the end of 1942 when he was assigned to special duties investigating jet engine development in the United Kingdom. Subsequently he helped to establish a cold weather station for jet engine testing at Winnipeg, Manitoba. When this project was transferred to Turbo Research Limited in 1944, he was appointed officer in charge. He has been chief engineer of the gas turbine division with A. V. Roe Canada Limited since 1946.

C. E. Garnett, M.E.I.C., has been appointed a member of the Advisory Board of

the Royal Trust Company and a director of Alberta Consolidated Gas Utilities Limited and of the Canadian American Land and Explorations Company Limited.

Mr. Garnett is president and manager of Gorman's Limited at Edmonton, Alta. and has been prominent in activities of the Canadian Chamber of Commerce in Alberta. He is a past-president of the Association of Professional Engineers of Alberta, a past-chairman of the Edmonton Branch of the Engineering Institute and a past vice-president of the Canadian Institute of Mining and Metallurgy.

Dean R. M. Hardy, M.E.I.C., dean of engineering, University of Alberta; **N. M. McCallum,** chief engineer, Department of Public Works, British Columbia; **Dr. Norman W. McLeod,** M.E.I.C., Highways Committee, Ontario Research Council; **L. H. McManus,** M.E.I.C., assistant chief engineer and soils engineer, Department of Highways, Alberta; **R. G. White,** M.E.I.C., deputy minister of public works and highways, Prince Edward Island; and **Walter Youngman,** Trans-Canada Highway Division, Department of Resources and Development; have been named members of a new committee of the Canadian Good Roads Association.

They represent the provincial and federal governments and educational and research institutions, to study the problem of wear and tear on highways. The Committee is to report on tests being conducted in the United States by the Highway Research Board.

Col. D. A. G. Waldock, M.E.I.C., former B.B.C. broadcast and television engineer, has recently been promoted to the rank of colonel and named superintendent and commanding officer of the Canadian Armament Design and Experimental Establishment at Valcartier, Que.

Col. Waldock was formerly deputy director of armament development at Army Headquarters.

Born at Ramsgate, Kent, Col. Waldock graduated from London University in 1936 with an honours B.Sc. in electrical engineering. Enlisting as a signalman in 1939 with the Royal Corps of Signals, Col. Waldock was commissioned in 1940 and rose to lieutenant-colonel in 1945. During the War he served for a time at the War Office and with the British Army Staff in Washington. He was commissioned in the Royal Canadian Artillery in 1946 as a major.

J. J. Smith, M.E.I.C., has formed a new company known as Smith Heating, Refrigeration & Air Conditioning Inc., in Montreal. He has an exclusive franchise for the General Electric oil-fired boiler burner unit for the Island of Montreal, and he is the G. E. representative for their complete line of commercial and industrial refrigeration and air conditioning.

Mr. Smith has been in this industry for the past 21 years, during ten of these years being associated with the Canadian General Electric Company in the engineering and service of this type of equipment.

During the recent war Mr. Smith was in the R.C.N.V.R. as an electrical officer, serving as officer in charge of the naval electrical department at H.M.C. Dockyard, Halifax; and as supervisor of electrical personnel for the Canadian Navy. He later served with the Royal Navy in aircraft carriers.

On his return from England, Mr. Smith joined C.G.E., and later worked for Mongeau and Robert as manager of the air conditioning division and for Chardo Industries, as chief engineer.

E. H. Hayes, M.E.I.C., has recently been appointed chief engineer of the communications equipment division of the Northern Electric Company Limited to succeed E. G. Gagnon, M.E.I.C.

Mr. Hayes joined the Company in 1928 as an engineer after graduating from the University of New Brunswick in electrical engineering.

He became supervisor of transmission equipment standards in 1944 and was made assistant superintendent of communications service engineering the following year. He was appointed assistant chief engineer in 1948.

Mr. Hayes is a member of the Corporation of Professional Engineers of Quebec.

E. G. Gagnon, M.E.I.C., former chief engineer of the communications equipment division of the Northern Electric Company Limited, has recently been appointed sales manager.

Mr. Gagnon, chief engineer of the division since 1947, joined Northern Electric after receiving his B.Sc. degree from McGill University in 1928. From engineering sales he went to the position of equipment service superintendent, superintendent of government sales and, finally, chief engineer.

He is a member of the Corporation of Professional Engineers of Quebec, and of the American Society of Quality Control.

L. Schenker, M.E.I.C., has accepted a position as research associate at the University of Michigan for two years. He will be concerned with the reviewing and reporting on all work which is being carried out in the United States and other parts of the world on the subject of the ultimate strength of steel structures with emphasis on the strength of connections.

Mr. Schenker was born in Vienna, educated in London, England, where he graduated from the Battersea Polytechnique College in 1942, and received a degree of M.A.Sc. from the University of Toronto in 1950.

After serving with the R.A.F. from 1942 to 1946, he became manager and director of Metag Limited, London, England. Since 1948 he has been assistant research engineer with the Hydro Electric Power Company of Ontario, at Toronto.

Paul Kellogg, M.E.I.C., president and managing director of Stevenson and Kellogg Ltd., Montreal, has been appointed chairman of the board of the Company.

Mr. Kellogg became president of Stevenson and Kellogg in 1936. He had previously worked in the United States. From 1933-1936 he was senior member of the engineering staff of Stevenson, Jordan & Harrison, New York. Earlier he was a member of the research staff of the National Industrial Conference Board, New York. He is a graduate of Massachusetts Institute of Technology.

N. O. Paquette, M.E.I.C., former vice-president of the western division of Stevenson and Kellogg, Limited, has recently been appointed president and managing director of the company.

Mr. Paquette joined this company in 1942 as senior engineer at Toronto, later becoming chief engineer, Pacific Coast, with the Vancouver branch in 1945. Previously he had worked with the Chrysler Engineering Corporation at Windsor, Ont., and for a time as technical advisor to the automotive production branch of the Department of Munitions and Supply at Ottawa. He is a graduate of the Massachusetts Institute of Technology and of the Chrysler Institute of Engineering.

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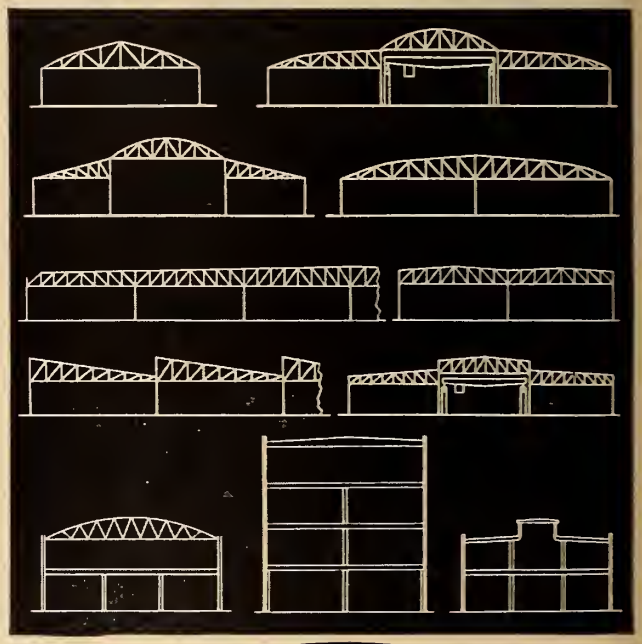

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F. R. Manuel, M.E.I.C., is vice-president of Stevenson and Kellogg Limited.

Mr. Manuel joined this company in 1942 as management engineer at Toronto and became supervising engineer in 1944. He was appointed vice-president in charge of the Toronto office in 1946. He has previously worked in New York, Chicago and Montreal for the Canada Dry Ginger Ale Company as a chemist and plant manager.

He obtained B.A.Sc. and M.A.Sc. degrees from the University of Toronto in 1925 and 1927.

W. D. G. Stratton, M.E.I.C.
Chairman of the Moncton Branch

The announcement of the election of Mr. Stratton as chairman of this branch was made in a previous issue of the *Journal*.

S. J. Carew, M.E.I.C., professor of engineering at Memorial University, St. John's, Newfoundland, has been elected to serve as chairman of the Newfoundland branch of the Institute.

Mr. Carew was born at Bell Island, Newfoundland. He studied at Dalhousie University and at the Nova Scotia Technical College, graduating in 1938. He worked for four years as a junior engineer with the Dominion Steel and Coal Corporation. In 1941 he became head of the engineering department of Memorial University, and was appointed associate professor, and later a professor.

During the summer months, he has done aerial survey work with the Department of Natural Resources, and road construction work at Fort Pepperrell Base. He has done field work for the St. John's Housing Corporation, surveys for the Department of Public Works of the Newfoundland Government, and with the Wabana Ore Company Limited at Bell Island.

Mr. Carew is a member of the Nova Scotia Technical College Alumni and of the College Senate.

T. Foulkes, M.E.I.C., has been promoted to chief plant engineer of the E. B. Eddy Company, Ottawa, in charge of the operation of the mechanical maintenance, electrical construction and steam departments. These departments have recently been consolidated into one administrative group.

Mr. Foulkes has been associated with power steam and maintenance work in the Company's mills since 1945, when he was appointed a plant engineer.

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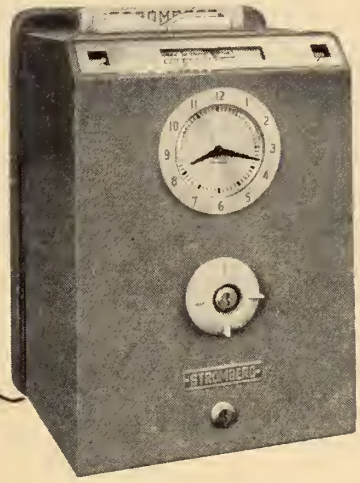

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George Stephenson, M.E.I.C., has been promoted to assistant plant engineer with the E. B. Eddy Company Limited.

Mr. Stephenson has had long experience in mechanical maintenance and engineering; he joined this company in 1930 and held the position of mechanical superintendent prior to his recent appointment.

A. N. Ball, M.E.I.C., has recently been appointed resident consultant with the E. B. Eddy Company.

Mr. Ball has been with this company since 1930 and was chief engineer for many years. He graduated from Queen's University in 1914. He did commercial surveying for Parsons Engineering Company, and design and construction work for the Saskatchewan Government, the Canada Sugar Refining Company, the Riordon Pulp Corporation and the St. Lawrence Paper Mills Limited. He has qualified as both a Dominion Land Surveyor and Saskatchewan Land Surveyor.

K. F. Wrangell, M.E.I.C., has been appointed chief design engineer with the E. B. Eddy Company, Ottawa, and will be responsible for the operation of the new engineering department.

Mr. Wrangell who has been with E. B. Eddy Company since 1929, was assistant chief engineer of the company before his recent appointment.

G. M. Webster, M.E.I.C., has been transferred from the Vancouver office of Transcontinental Resources Limited to the Calgary office of Bralsaman Petroleums Limited where he holds the position of office manager. Previously he was assistant to the manager of mines for Transcontinental Resources Limited.

W. C. Fisher, M.E.I.C., has joined the Lenkurt Electric Company Inc. of San Carlos, California, as an engineering representative.

Mr. Fisher was previously vice-president in charge of operations and assistant general manager with the Norwesto Communications Limited at Kenora, Ont.

He graduated from the University of Saskatchewan in 1935 and obtained a M.Sc. degree from Purdue University in 1938.

P. L. Climo, M.E.I.C., has joined the staff of the Ontario Paper Company at Thorold, Ontario.

Mr. Climo graduated from Queen's University in mechanical engineering in 1932 and worked for a time with the Gardiner Construction Company of Welland. Later he was employed by the Town of Cobourg, designing and supervising in the field for street sewers, foundations and structures; and by the Hollinger Consolidated Gold Mines at Timmins, Ontario. In 1940 he accepted a position with the Gaspesia Sulphite Company at Chandler, Que., on the mill engineering staff. In 1942 he worked with the Toronto Shipbuilding Company on war emergency work and in 1943 on designing of gun mounts for Armstrong Wood and Company at Toronto. From 1944 to 1947 he worked with the Frost and Wood Company in engineering work associated with manufacture of munitions and later, on tool design for farm machinery. At this time Mr. Climo took an active interest in municipal government and ,was twice elected to Town Council at Smith Falls, Ont.

From 1947 until his present appointment he was with the Canadian International Paper Company at their sulphite pulp mill in Temiskaming and was elected to the position of vice-chairman of the recently inaugurated North Bay-Temiskaming Branch of the Institute.

G. L. Philips, M.E.I.C., has accepted a position with Sir William Halcrow and Partners in London, England, and will be residing in England for several years.

Before going to England last year, Mr. Philips was with the Canadian Brazilian Services Limited at Toronto, Ontario. Previously he had worked with the Consolidated Mining and Smelting Company at Trail, B.C., as a design engineer, and as a mining engineer with the St. John Dry Dock and Shipbuilding Company Limited at St. John, N.B.

He graduated from the University of London, England, in 1939.

P. L. Mathewson, M.E.I.C., has been appointed chief of research for the Canadian National Railway system.

Mr. Mathewson is a graduate from the University of British Columbia where he obtained a B.A.Sc. degree in electrical engineering in 1927. He joined the Canadian National Railways in 1930 and was an electrical inspector in the motive power department at Toronto until 1937 when he was transferred to Montreal as assistant engineer in the chief electrical engineer's office. He was promoted to research engineer in 1943, and to transportation engineer in the operation department in 1946.

This year Mr. Mathewson won the Ross Medal of the Institute for his paper "Application of Diesel Electric Locomotives". He is a member of the Corporation of Professional Engineers of Quebec.

G. L. Plow, M.E.I.C., of Canadian National Railways, Montreal, has been appointed assistant chief engineer for the system.

Mr. Plow graduated in civil engineering from McGill University in 1924 and joined the Central Vermont Railway at St. Albans, Vt. He came to the Canadian National Railway at Quebec in 1929 and served on numerous divisions of the road until 1940 when he joined the Canadian Army. On his return to the C.N.R. in 1946, he was appointed assistant division engineer on the Laurentian division and in the same year was transferred to Ottawa as division engineer. He served in this capacity at Levis, Que. and London, Ont., and in 1948 was made general maintenance inspector at Montreal.

In 1949 he was appointed senior assistant engineer and in 1950 was named engineer of track for the system.

Robert Quintal, M.E.I.C., has joined the firm of Construction Borings Limited at Montreal, Que., as chief engineer.

Mr. Quintal graduated from Ecole Polytechnique in 1943 and the following year obtained a master's degree in civil engineering for his work on prestressed concrete. He also attended Purdue University for three years where he obtained training in the field of soil mechanics. During these years he worked for the summer months as a soils engineer for

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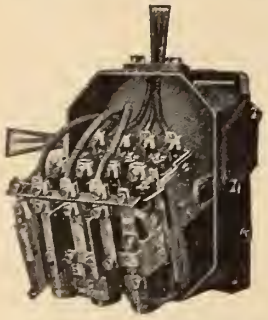

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the Government of the Province of Quebec.

Prior to his present appointment Mr. Quintal was in charge of foundation and design for the Subway Design Division of the Montreal Transportation Commission. He is author of a number of papers in the field of prestressed concrete and soil mechanics.

G. C. Scowcroft, M.E.I.C., has joined The Philips Carey Company Limited at Montreal as general sales manager. He previously held the position of manager of the Trafalgar Mills Limited at South Nelson, N.B. He graduated from the University of Saskatchewan in 1942 in civil engineering.

C. J. Somers, M.E.I.C., has left the Robin Hood Flour Mills Limited to join the International Milling Company at Minneapolis, Minnesota.

Mr. Somers had been with the Robin Hood Flour Mills Limited since 1945 as divisional engineer at Humberstone, Ont., and as plant and maintenance engineer at Moose Jaw, Sask. Earlier he was safety engineer for the Stormont Chemicals Company Limited at Cornwall, Ontario.

He graduated in civil engineering from the University of New Brunswick in 1936.

J. H. Kent Lyons, M.E.I.C.

J. H. Kent Lyons, M.E.I.C., has been appointed general manager of manufacturing for the operations of General Steel Wares Limited.

Mr. Lyons has a wide knowledge of and experience in metal working industries in Canada. He gained his degree in electrical engineering from the University of Manitoba in 1936, and obtained a degree in mechanical engineering from McGill University in 1937. He is a member of the Ontario Association of Professional Engineers.

Denis Temple, M.E.I.C., has joined Defence Construction Limited at Ottawa, Ont. He was previously assistant resident engineer with Defence Industries Limited at Valleyfield, Que.

Mr. Temple graduated in civil engineering from the City and Guilds College in London, England, in 1936. He has worked on design for the McColl Frontenac Oil Company Limited at Montreal and as superintendent on inspection and general services with the National Research Council Atomic Energy project at Chalk River, Ontario.

F. K. Henning, M.E.I.C., has joined Stadler and Hurter, consulting engineers, at Montreal, Que. He was previously with the Duchane Roche Company, importers for machinery and tools where he was associated with sales, correspondence and quotations.

Mr. Henning graduated from McGill University in 1943.

P. D. Hobson, M.E.I.C., is an assistant research officer in the mechanical engineer division of the National Research Council at Ottawa, Ont.

Mr. Hobson is in charge of experimental heavy machinery and plant in the gas dynamics division.

Previously he has worked with the Dominion Engineering Works at Lachine, Que. He graduated from the Royal Naval Engineering College in 1943.

Vincent Casson, M.E.I.C., is in private professional practice as a management consultant, with offices in Montreal, and in Edmonton, Alberta.

Mr. Casson was previously an industrial engineer with the Industrial Development Bank at Montreal. He graduated with a B.A.Sc. degree in electrical engineering from the University of British Columbia in 1942.

J. M. Takacs, Jr.E.I.C., has joined Woodall Brothers, general contractors, in Windsor, Ont., as an estimator.

Previously he was estimator and buyer for Granite Construction Limited at Windsor, Ontario. Mr. Takacs graduated from the University of Detroit in 1950.

H. K. Craibbe, Jr.E.I.C., has been appointed construction engineer with A. Cope and Sons, Limited, general contractors at Hamilton, Ont. Previously he was with the Ontario Department of Highways at Hamilton, Ont. Earlier he was at Owen Sound, Ont., as assistant construction engineer, and in the survey branch in Toronto, Ont.

Mr. Craibbe graduated with a B.A.Sc. degree in civil engineering from the University of Toronto in 1945.

R. C. Somerville, Jr.E.I.C., of Hornepayne, Ont., has left the Canadian National Railways, to work for the Greater Winnipeg Water District at Winnipeg, Manitoba.

Mr. Sommerville graduated in civil engineering from the University of Manitoba in 1949.

R. Sadler, Jr.E.I.C., has joined the Northern Electric Company Limited at Montreal.

Mr. Sadler graduated in mechanical engineering from McGill University in 1950.

W. B. Jennings, Jr.E.I.C., has joined the Deloro Smelting and Refining Company Limited at Deloro, Ontario.

Previously he was on a training course with the Canadian Westinghouse Company Limited at Hamilton, Ont. Mr. Jennings graduated in mechanical engineering from McGill University in 1950.

V. K. Jameson, Jr.E.I.C., has been appointed assistant manager with the Dominion Tar and Chemicals Company in Edmonton, Alberta.

Previously he was assistant supervisor of operations with this company at Calgary, Alberta.

Mr. Jameson graduated in mechanical engineering from the University of Saskatchewan in 1950.

W. H. Armstrong, Jr.E.I.C., is employed by the Naval Research Establishment at North Dartmouth, Nova Scotia.

Mr. Armstrong graduated in electrical engineering from the Nova Scotia Technical College in 1950.

G. B. McLellan, Jr.E.I.C., has left the highway testing laboratory of the Department of Public Works, Victoria, B.C., to join the Aluminum Company of Canada Limited at Vancouver, where he is working in the target estimating department.

Mr. McLellan graduated with a B.A.Sc. degree in civil engineering from the University of British Columbia in 1950.

B. D. Mathers, Jr.E.I.C., has joined the Kilborn Engineering Company at Toronto, Ont. Previously he was assistant engineer with the East York Township at York Mills, Toronto, Ont.

Mr. Mathers graduated in civil engineering from Queen's University in Belfast, Ireland, in 1950.

R. W. Lockie, Jr.E.I.C., has returned to Canada after spending two years in Rugby, England, with the English Electric Company. He is now working in the steam turbine sales office of the English Electric Company of Canada at St. Catherines, Ont.

Mr. Lockie graduated with a B.A.Sc. degree in mechanical engineering from the University of British Columbia in 1950.

William Flanagan, Jr.E.I.C., is a mechanical consultant in the partnership of Flanagan and Black, at Toronto, Ont.

Previously he was sales engineer with the C. A. Dunham Company Limited at Toronto. He graduated in 1948 with a B.A.Sc. degree in mechanical engineering from the University of Toronto.

Capt. F. G. Johnson, Jr.E.I.C., is at the Military College of Science at Shrivenham, Wiltshire, England, on a technical staff course. Previously he was stationed at Regina, Saskatchewan, with the R.C.E.M.E.

Captain Johnson graduated in mechanical engineering from the University of Saskatchewan in 1949.

B. A. Warren, Jr.E.I.C., is working at Gaspe, Que., as resident townsite engineer on the staff of Dineen, Philips and Roberts, consulting engineers, and will supervise the building of utilities such as water supply, distribution, sewage collection disposal, storm drainage, streets and bridges, etc., for a townsite for Gaspe Copper Mines.

Mr. Warren graduated in civil engineering from the University of Toronto in 1950 and then worked with Hugh Lumsden, of Hamilton, later going into partnership with him on municipal consulting work.

He has been active in the Hamilton Branch of the Institute, serving as chairman of the Students and Juniors Papers Competition, and also as news editor.

C. R. Eaton, Jr.E.I.C., has recently joined C. D. Howe and Company Limited, consulting engineers at Montreal.

Previously he was working in the design department of A. V. Roe Canada Limited at Malton, Ont. Mr. Eaton graduated in mechanical engineering from the University of Saskatchewan in 1949.

D. W. Hawes, Jr.E.I.C., has accepted a position with the National Steel Car Corporation Limited in Hamilton, Ont.

Previously he was with the Canadian General Electric Company at Peterborough, Ont.

A. M. Symes, Jr.E.I.C., is with the Patino Mines and Enterprise Consolidated, Inc. in Bolivia, South America.

Mr. Symes graduated in mining engineering from McGill University in 1950.

G. W. Bond, Jr.E.I.C., has joined the Barrett Company Limited at Joliette, Quebec, as plant engineer.

Mr. Bond graduated in civil engineering from the University of New Brunswick in 1946 and commenced work with the Canada Cement Company at Montreal. Later he became design engineer with the Canadian International Paper Company at Three Rivers, Que.

E. L. Fytche, Jr.E.I.C., is employed with the British Electricity Authority in Surrey, England.

Previously he was a junior engineer with the Gatineau Power Company at Ottawa, Ont.

Mr. Fytche graduated in electrical engineering from the University of New Brunswick in 1947.

M. H. Nelson, Jr.E.I.C., has been appointed by International Water Supply Lim-

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ited to take charge of the Company's new office in Edmonton as field engineer. Previously he worked with the company at London, Ont.

Mr. Nelson graduated with a B.A.Sc. degree in civil engineering from the University of Toronto in 1950.

W. J. Gall, JR.E.I.C., of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris, has been promoted to scientific officer and transferred to Djakarta, (Java), Indonesia, to assist the head of the UNESCO Science Co-operation Office

William J. Gall, JR.E.I.C.

for South East Asia in establishing the latest of five Science Co-operation Offices maintained by UNESCO in the 'under-developed' areas of the world, opened last year.

Mr. Gall is at present acting head of the UNESCO mission in Djakarta.

After leaving Paris last September he returned to Canada on home leave before taking up his new duties in November last.

In June, 1950 he was awarded the degree of Doctor of Natural Sciences by the Swiss Federal Institute of Technology; he is a graduate from the University of Toronto.

B. Kahane, S.E.I.C., has been appointed branch sales manager for Vulcan Iron and Engineering Limited at the new branch sales office at Regina, Saskatchewan.

Mr. Kahane graduated in chemical engineering from the University of Toronto. He is also a graduate in ceramic engineering from the University of Saskatchewan.

A. A. Ward, JR.E.I.C., is assistant district engineer with the Ontario Department of Highways at Port Hope, Ont.

Mr. Ward graduated in civil engineering from Queen's University in 1950 and joined the Ontario Department of Highways the same year.

M. S. Tempest, JR.E.I.C., is an engineer in the mechanical department of Imperial Oil Limited at the Refinery at Edmonton, Alta.

Mr. Tempest graduated in civil engineering from the University of Alberta in 1950.

E. J. Loen, S.E.I.C., (University of British Columbia, mechanical engineering, 1952), holds the position of junior design engineer at the National Research Council at Ottawa, Ont.

G. J. Melanson, S.E.I.C., (Nova Scotia Technical College, mechanical engineering, 1951) is supervisor of the board department with Building Products Limited, at Pont Rouge, Portneuf Co., Que. He has been working with the Company in Montreal.

A. Scharf, S.E.I.C., University of Saskatchewan, electrical engineering, 1952, is employed as junior engineer with Canadian National Telegraphs at Toronto, Ont.

B. Kahane, S.E.I.C.

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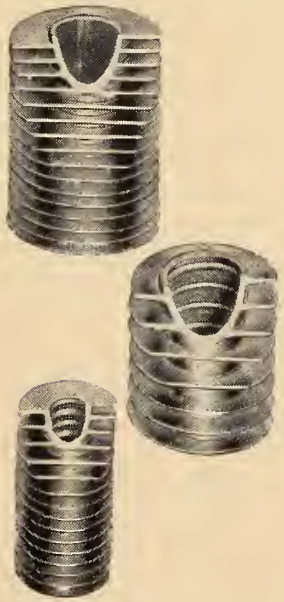

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G. D. Mackay, S.E.I.C., (McGill University, civil engineering, 1952) is with Grant Mills Limited at St. John's, Newfoundland.

C. V. MacEachern, S.E.I.C., is a flying officer in the R.C.A.F., stationed with the Technical Training Unit in Montreal.

Flying Officer MacEachern graduated in mechanical engineering from the University of Nova Scotia in 1951.

N. T. Lazarou, S.E.I.C., (University of Toronto, mechanical engineering, 1952) is employed with the Ford Motor Company at Windsor, Ont., as a plant layout draughtsman.

R. S. Jermyn, S.E.I.C., is employed by the Canadian Westinghouse Company Limited at Hamilton, Ont., as a graduate student engineer.

Mr. Jermyn graduated from the Nova Scotia Technical College in mechanical engineering in 1952.

R. M. Jost, S.E.I.C., is a design engineer with the Shawinigan Engineering Company at Montreal. He graduated from the Nova Scotia Technical College in civil engineering in 1951.

W. H. George, S.E.I.C., is employed in the engineerng and architectural division of the Department of Resources and Development at Jasper, Alberta.

Mr. George graduated from the University of Saskatchewan in civil engineering in 1951.

E. F. Freeman, S.E.I.C., is a telecommunications officer in the R.C.A.F. at Vancouver, B.C.

Flying Officer Freeman graduated from the University of Alberta in electrical engineering in 1951.

Visitors to Headquarters

P. J. Wiggs, Halifax, N.S., July 30, 1952.

M. L. Walker, M.E.I.C., Sarnia, Ont., July 31, 1952.

R. L. Hearn, M.E.I.C., Queenstown, Ont., July 31, 1952.

W. R. Alexander, M.E.I.C., Toronto, Ont., August 1, 1952.

Professor H. P. Herbich, M.E.I.C., London, England, August 1, 1952.

A. J. Wade, S.E.I.C., Toronto, Ont., August 4, 1952.

H. Stoller, JR.E.I.C., Ottawa, Ont., August 4, 1952.

A. H. W. Busby, M.E.I.C., Trail, B.C., August 4, 1952.

D. M. Buist, London, England, August 7, 1952.

I. M. Foster, M.E.I.C., Kapuskasing, Ont., August 7, 1952.

C. Barrowski, Brussels, August 8, 1952.

J. G. H. Loubser, South Africa, August 8, 1952.

W. F. Bennett, S.E.I.C., West Vancouver B.C., August 12, 1952.

R. G. Martin Cosgrave, Northern Ireland, August 12, 1952.

R. E. Williams, M.E.I.C., Mackenzie, British Guiana, August 14, 1952.

L. L. Earley, S.E.I.C., Sudbury, Ont., August 14, 1952.

A. A. Halaway, Montreal, August 18, 1952.

D. Van Lith, Nigmegan, Holland, August 21, 1952.

C. Friguet, Paris, France, August 22, 1952.

Obituaries

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

Dr. T. Kennard Thomson, M.E.I.C., world-famous inventor and engineer who died in New York July 1 at 88 years of age, founded the University of Toronto Engineering Society in 1884. Two years later he graduated at the head of his civil engineering class from the School of Practical Science, University of Toronto. He joined the Engineering Institute in 1905 and became a life member in 1936.

"He has spent a great deal of energy, enthusiasm and money on schemes so vast in concept that they stagger men of lesser imagination," declared the Engineer's Club News in its May issue. One of these was to fill in Upper Bay by extending Manhattan Island six miles southward to the Narrows, thus gaining an additional nine square miles of useful land. To ease Manhattan's traffic, he proposed four-deck avenues — one for rapid-transit trains, one for trucks, one for pedestrians and the other for buses, taxis and private automobiles.

Dr. Thomson worked out a 2,000,000 hp. scheme for the Niagara and the St. Lawrence rivers. And he planned a National Forest belt 20 miles wide extending from Lake Superior to the Pacific. Another scheme was to drain the Mississippi Valley by building three concrete riverbeds designed to divert flood waters to the Gulf of Mexico. He made provision in his plans for using the power from this diverted water.

But of all his vast schemes, many of which were praised by such notables as Thomas A. Edison, his favorite was to transform New York into a "super city". In addition to the four-deck avenues, he planned huge buildings in the Upper Bay area which was to be enclosed with huge caissons and partly filled by dredges and then pumped dry. The buildings were to be 2,000 feet high, with flat roofs for aircraft to land on. He calculated the cost of this "super city" would be $400,000,000 but its value would be $15,000,000,000.

"At one time he probably knew more about what lies beneath the surface of Manhattan Island than any other man," declared the Engineer's Club News. He built cofferdam foundations for many of New York's skyscrapers.

Until a week before his death, when he collapsed from over-exertion in the heat, Dr. Thomson was an active consulting engineer, going to his office in the Engineer's Club, 32 West 40th Street, every day. "He was a confirmed optimist," declares his daughter, Dr. Annis E. Thomson. "A week before he collapsed, he said: 'I may kick the bucket, but I have ten years' work to do.'" After collapsing, his daughter reports, Dr. Thomson regained consciousness briefly the next day and said: "I don't think I'll go to New York tomorrow."

Only in recent years did Dr. Thomson abandon his famous 15-mile walk from the Engineer's Club to his home in Yonkers in celebration of his birthday on April 25. In 1936 he received a medal for this annual feat from the late Dr. John H. Finley, editor of the New York Times, himself a famous walker.

Born in Buffalo in 1864, Dr. Thomson was a son of William Alexander Thomson, originator and builder of the Canadian Southern Railroad and a member of Parliament. From April to October of the years 1883 to 1885 he worked as a draughtsman and rodman on the Rocky Mountain Division of the C.P.R. After graduating he joined the Dominion Bridge Co. as a draughtsman. He then was engineer for several bridge building companies, becoming a widely recognized authority on pneumatic caissons. He planned foundations for buildings on Manhattan Island which required caissons 100 feet below the street level. He was a consultant in the construction of 50 major buildings and more than 200 bridges. Dr. Thomson held several patents for tunnel and lighthouse construction.

Dr. Thomson contributed hundreds of papers to engineering journals and wrote numerous articles for New York newspapers.

W. C. Watt, M.E.I.C., mechanical superintendent for the Robert Simpson Company Limited at Toronto, died suddenly at the Toronto Western Hospital on Monday, August 4th, 1952.

Mr. Watt was born in Scotland in 1901 and received his early engineering training in Fraserburgh and Glasgow. He came to Canada in 1926 and was employed as mechanical superintendent with the National Textiles Limited and later with Willard's Chocolates Limited, at Toronto, Ont.

During the Second World War, he was loaned by the Robert Simpson Company to the Department of Munitions and Supply as chief engineer in the office of the Co-ordinator of Production. He has been mechanical superintendent of the Robert Simpson Company Limited at Toronto since 1941.

Mr. Watt joined the Institute as a member in 1945 and was secretary-treasurer of the Toronto branch at the time of his death.

Employment Service

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

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

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

Situations Vacant

CHEMICAL

CHEMICAL ENGINEER or bachelor of science required to work as development engineer in Montreal. Duties would include development work in latex and reclaim rubber and possibly some work on cements and adhesives. Apply to File No. 4332-V.

CHEMICAL ENGINEER to act as development engineer in applied chemical research and process development to pilot plant stage. A bachelor's degree with high academic standing. Preference will be given to those with post-graduate training or with proven aptitude for research and development work. Salary range $3,550. to $5,200. per annum according to education and years of related experience. Excelent accommodation, housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

JUNIOR ENGINEER or technical graduate with chemical background for technical control in the synthetic fibre industry. A certain amount of laboratory control and development work will be involved, a knowledge of statistical evaluation or quality control would be an asset. Good opportunity for eventual advancement into the production department. Pension plan, group insurance and cost-of-living bonus provided. Location in progressive town in Eastern Townships about seventy miles from Montreal. Apply to File No. 4337-V.

CHEMICAL ENGINEER required to act under direction of the officer in charge of the materials section of the directorate of Armament Development, to make specific investigations and studies with respect to the use of non-metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and development organizations in Canada, the United States and United Kingdom. Graduation in Chemical Engineering from a recognized university; about six years' experience in the plastics field; ability to prepare well written reports; personal suitability; physical condition. Apply to File No. 4347-V.

CHEMICAL ENGINEER to act under direction of the officer in charge of the propellants and explosives section of the Directorate of Armament Development, to make specific investigations and studies with respect to ammunition explosives and propellants. Duties will require close liaison with the chemical industry and visits to armament design and development establishments in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in chemical engineering; about four years' diversified experience at increasingly responsible levels in the chemical engineering field; experience in development, inspection or production of explosives preferred; ability to prepare well written reports; personal suitability, satisfactory physical condition. Apply to File No. 4347-V.

CIVIL

CIVIL ENGINEER required by a long established engineering and surveying firm located in Ontario. Must have at least two years practical experience Reply stating age, experience and salary expected to File No. 4336-V.

QUALIFIED CIVIL ENGINEER with experience in varied municipal engineering work required in Western Canada Applicant to state age, experience and salary required. Apply to File No 4345-V.

CIVIL ENGINEERS required for operations in Labrador. Three field engineers with 10 years experience, also assistant field engineers with a minimum of 5 years experience. Work consists of construction of roads, camps, docks and air fields, etc. Apply to File No. 4349-V.

RECENT GRADUATE chemist or chemical engineer to assume direction of laboratory for control physical and chemical plant producing abrasives. Located in Quebec. Married men preferred, housing available. Salary commensurate with experience. Apply to File No. 4350-V.

ELECTRICAL

GRADUATE B.Sc., preferably with test course and sales experience in electrical apparatus equipment, age around 30 to 35. Salary open. Apply to File No. 4342-V.

ELECTRONICS ENGINEER to act under the supervision of the ofifcer in charge of the Analysis Section of the Directorate of Rearmament Development to be responsible for the electronic engineering phases of the analysis of weapon systems. Duties will require visits to armament design and development organizations in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in Electrical Engineering; about six years' diversified experience at increasingly responsible levels in the electronic engineering field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament Development, to make specific investigations and studies with respect to guided missiles, serve mechanisms, remote and other control systems. Duties will require close liaison with industry and visits to armament design and development establishments in Canada and the United States and the United Kingdom. Graduation from a university of recognized standing in Electrical engineering; about five years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production, ability to prepare well written reports; personal suitability, satisfactory physical condition. Apply to File No. 4347-V.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament development to make specific investigations and studies with respect to test equipment such as velocity and radar doppler measurement, high speed scopes, monitor units, radar targets, meters, special instruments to follow flight of shell or rockets. Duties will require close liaison with industry and visits to armament design and development establishments in Canada, the United States and the United Kingdom. Graduation from a university of recognized standing in Electrical engineering; about four years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production. Apply to File No. 4347-V.

ELECTRICAL ENGINEERS recent graduates or experienced to work on communications with large organization in Montreal. Apply to File No. 4348-V.

MECHANICAL

MECHANICAL ENGINEER to act as development engineer in experimental work connected with design of atomic energy reactors and associated equipment. A bachelors degree with high academic standing. Preference will be given to those with post graduate training or with proven aptitude for research and development work. Salary range $3550. to $5200. per annum according to education and years of related experience. Excellent accommodation housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

PLANT ENGINEER to supervise and coordinate all plant engineering activities including mechanical maintenance on production equipment, erection and repair on heavy machinery, maintenance of buildings, roadways, etc. and utilities services. For medium sized manufacturing plant located in suburban East Toronto, to work closely with two major production departments and direct maintenance schedules to achieve a minimum of dislocation of production operations. Responsible directly to the plant manager. Must be aggressive but co-operative and able to handle a maintenance work force of 60 to 70 men Good salary and employee benefits. Excellent prospects for future with a well-established and progressive organization. Apply to File No. 4335-V.

MECHANICAL ENGINEER, recent graduate to learn air conditioning design, estimating and draughting. Location Montreal. Apply to File No. 4343-V.

MISCELLANEOUS

PLANT ENGINEER required by one of Canada's largest textile mills located in the Maritimes engaged in the manufacture of rayon fabrics. Applicant should have executive qualifications and experience in the mechanical and electrical fields. Job covers maintenance of

buildings and machinery, plant protection, planning for new projects, responsibility over power and steam generation and costs. Apply to File No. 4334-V.

DRAUGHTSMAN REQUIRED by organization in Ontario. Applicant should possess either civil engineering training, structural option preferred, and some experience in steel and concrete building work, or several years experience in a good drawing office. Apply to File No. 4338-V.

GRADUATE ENGINEER, electrical or mechanical, with a minimum of five years experience in industrial or process engineering, for modern pulp mill in Northwestern Ontario. Salary open depending on experience. Excellent group insurance and pension plans available. Apply in writing stating full particulars of experience, age, marital status, availability, etc. to file No. 4339-V.

PROCESS ENGINEERS to study facilities of fabrication to adequate available equipment. Study of production output to its lowest manufacturing cost. Plan sequences of operations to be followed in producing an article, specify machines, fixtures, cutting tools and set-up to be used. Qualifications: University graduate or equivalent, proven knowledge of machine shop practice (production), toolmaking. Modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

TIME STUDY and methods technicians to complete application of time and motion study and methods engineering technique. University graduate or equivalent. Training on time and motion study. Proven experience in methods engineering and mechanical background. Good salary and working conditions in modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

SALES ENGINEER (mechanical or civil) preferably with ten years experience with industry required by a firm of industrial engineers in Ontario. Excellent opportunity for an engineer who is able to meet executives of industry and to promote engineering services. Apply to File No. 4341-V.

ELECTRONIC AND MECHANICAL ENGINEERS to do development engineering work on electronic equipment and production engineering work in the fabrication and assembly of electronic equipment respectively. Location Ontario. Apply to File No. 4344-V.

PROFESSIONAL ENGINEERS required in Province of Quebec by manufacturer of newsprint paper and Kraft products in the capacity of assistant to sulphite superintendent, assistant to technical service superintendent, and an engineer to join the maintenance and engineering department staff. Apply to File No. 4346-V.

ENGINEER to exercise supervisory and technical control over the Analysis section of the Directorate of Armament Development and to prepare assessments of the effectiveness of weapon systems in collaboration with other technical officers. Graduation from a university of recognized standing in physics, mathematics or general engineering; post graduate training with successful completion of the requirements for a Master's degree in any of the above fields; about twelve years' diversified experience at increasingly responsible levels in the fields of physics, mathematics and/or engineering. Apply to File No. 4347-V.

ENGINEER to work in consultation with the officer in charge of the Analysis section of the Directorate of Armament Development, to be responsible for mathematical phases of analysis of weapon systems. Graduation from a university of recognized standing in mathematics or applied science; post graduate training with successful completion of the requirements for a Master's Degree; about six years' diversified experience at increasingly responsible levels in the Applied mathematics and Statistical Analysis Field. Apply to File No. 4347-V.

ENGINEERING PHYSICIST required to act under direction of the officer in charge of the Analysis Section of Directorate of Armament Development. to be responsible for physical engineering phases of analysis of weapon systems. Graduation from a university of recognized standing in Physics; post graduate training desirable; about six years' diversified experience at increasingly responsible levels in the physical engineering fields; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ENGINEER (BALLISTICIAN) to act under supervision of the officer in charge of the Analysis Section of the Directorate of Armament Development, to be responsible for the ballistic phases of the analysis of weapon systems; the preparation of terminal, external and internal ballistic evaluations. Graduation from a university of recognized standing in mathematics or physics; about six years' diversified experience at increasingly responsible levels in the applied mathematical field; experience in ballistics preferred; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ENGINEER (METALLURGIST) required to act under direction of the officer in charge of the Materials Section of the Directorate of Armament Development, to make investigations and studies with respect to use of metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and development organizations in Canada, the United States and United Kingdom. Graduation in metallurgical engineering from a recognized university; about six years' experience in the metallurgical field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

STRUCTURAL DESIGN ENGINEERS recently graduated or experienced. Some experience on hydraulic structures is preferable. Work for final stage of the design of power houses and dams. Consulting engineers for jobs in U.S.A. Apply to File No. 4351-V.

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

CHEMICAL

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

UNIVERSITY, located in Ontario has opening in the department of chemical engineering. Applicant should be capable of initiating and directing research in the chemical engineering aspects of the pulp and paper industry and also share in the instruction of undergraduate class. Apply to File No. 4284-V.

GRADUATE CHEMICAL engineer with industrial experience to head chemical and industrial engineering section of a large company near Montreal. Knowledge of distillation, heat exchange, filtration and thermal processes are desirable. Proven abilities as a leader essential. Good salary with excellent prospects. Group and retirement insurance benefits operated. Apply to File No. 4294-V.

CIVIL

CIVIL ENGINEER, familiar with modern methods of structural steel design, including indeterminate structures, welded and riveted, required in Quebec City. Permanent position. At least 5 years practical experience. Bilingual essential. Apply in French or English and state age, education, experience, references and salary expected. Apply to File No. 4283-V.

CIVIL ENGINEER required by the Canadian Institute of Steel Construction. Applicants should be bilingual with a minimum of ten years' experience for the position of Eastern Representative of their body, with headquarters in Montreal. Applicants should state particulars of education and practical background. The selected engineer must be prepared to travel in Eastern Canada covering all of the Maritime Provinces, Newfoundland and Quebec. Applications will be treated as strictly confidential. Apply to File No. 4312-V.

ELECTRICAL

ELECTRICAL ENGINEER required by University in B.C. to act as demonstrator for the session 1952-53 from Sept. 15 to May 31. Should be a University graduate in electrical engineering preferably under 30 years of age, with a knowledge of both electronics and power. Demonstrators are allowed to register for one post graduate course during the session if they so desire. Salary $2,000.00. Apply to File No. 4288-V.

ELECTRICAL ENGINEER required to act as advisor to the board of the Gal Oya development project in Ceylon on all matters relating to electricity including the erection of HT transmission lines, the purchase of necessary equipment, and general problems connected with distribution of electricity throughout the Gal Oya valley. Salary equivalent to those paid in Canada, plus a substantial tax free allowance. For further details apply to File No. 4291-V.

PROCESS ENGINEERS

DUTIES: Study facilities of fabrication to adequate available equipment. Study of production output to its lowest manufacturing cost. Plan sequences of operations to be followed in producing an article. Specify machines, fixtures, cutting tools and set-up to be used.

QUALIFICATIONS: University graduate or equivalent. Proven knowledge of machine shop practice (production) toolmaking. Ability to visualize, at a glance, project main points. Practical shop experience preferable.

TIME STUDY AND METHODS TECHNICIANS

DUTIES: Complete application of time and motion study and methods engineering technique.

QUALIFICATIONS: University graduate or equivalent. Training on time and motion study. Proven experience in Methods engineering. Mechanical background.

Good salary and good working conditions in modern plant in Central Canada. Permanent work.
Apply to File No. 4340-V.

City Engineer Required by City of Moose Jaw

Qualified Civil Engineer with experience in varied municipal engineering work. Applicant to state age, experience and salary required.

Applications to be made in writing to City Commissioner, City Hall, Moose Jaw, Sask.

ELECTRICAL ENGINEER recent graduate required for position covering Maritime Provinces, work to consist of design, draughting and field work for automatic controls and signalling. Apply to File No. 4292-V.

ELECTRICAL ENGINEER recent graduate required by organization in Montreal. Applicant should have capabilities to check shop installations and make layouts in accordance with preliminary outlines from senior supervision, a basic knowledge of industrial electronics, control applications and draughting. Apply to File No. 4300-V.

TWO ELECTRONIC ENGINEERS for production design of radar equipment. Applicants should have 3 to 5 years experience preferably. Location Ontario. Apply to File No. 4309-V.

ELECTRICAL ENGINEER, recent graduate, required by small manufacturer of power equipment for Montreal sales office. Previous experience in sales is desirable but not essential. Applicants must be bilingual. Apply to File No. 4315-V.

DEMONSTRATOR IN electrical engineering laboratories (circuits, electric machines, power) at the University of Toronto, for 1952-53 session. Apply to File No. 4327-V.

INSTRUCTOR OR JUNIOR lecturer for lecture and laboratory work in electric machinery and electric machine design at the University of Toronto, commencing with 1952-53 session. Apply to File No. 4327-V.

MECHANICAL

MECHANICAL ENGINEER 1952 graduate required for newsprint mill in Province of Quebec. Good opportunity for man interested in learning pulp and paper industry. Salary 3 0.00 per month Apply to File No. 4303-V.

MECHANICAL ENGINEER preferably with a masters degree and background and interest in hydrodynamics. An interest in ship structures would be of value. Duties include responsibility for the planning of trials and the collection, analysis and reporting of essential data on the performance characteristics of novel designs of surface craft and for design of structural modifications as trials results show desirable. Apply to File No. 4307-V.

MECHANICAL OR METALLURGICAL engineer with sales background to take full responsibility for a new Ontario business of small, well established American company, manufacturing bearing metals. Apply to File No. 4308-V.

MECHANICAL ENGINEER with about 5 to 10 years experience of production experience on radar equipment. Location Ontario. Apply to File No. 4309-V.

MECHANICAL ENGINEER required for field work in Ontario. Applicant with not less than 3 years experience in the installation of machinery and other mechanical equipment. Apply to File No. 4311-V.

FOUR GRADUATE MECHANICAL engineers required for work in Montreal office and four senior draughtsmen. Applicants should not have less than 3 years experience in detailed design of high quality machinery parts. Apply to File No. 4311-V.

MECHANICAL ENGINEER to act as sales engineer for American manufacturer with new plant in Canada. Applicant should preferably be familiar with internal combustion engines and automotive type equipment. Territory between Windsor and Toronto. Apply to File No. 4314-V.

MECHANICAL ENGINEER required in Montreal to act as assistant works engineer. Applicant should have 5 to 10 years experience in industrial work. Apply to File No. 4320-V.

MECHANICAL ENGINEER required by paper mill located in Province of Quebec, preferably with two or three years experience. Apply to File No. 4323-V.

MISCELLANEOUS

GENERAL BUSINESS and production manager required to take complete charge of a large modern plant manufacturing plywood, flush doors and hardwood flooring. This is a senior position with salary in line with experience and responsibility. Reply in confidence giving full detail. Location St. John's, Nfld. Apply to File No. 4286-V.

SALES ENGINEER required by nationally known manufacturer. Must have design or construction experience with power or telephone utility. Excellent future for young engineer with sales aptitude and willingness to work. Location Montreal with considerable travelling involved. Knowledge of French an advantage. Salary open depending on qualifications. Satisfactory performance of duties would lead to promotion to district manager Eastern Canada within 3 years. Apply to File No. 4290-V.

INDUSTRIAL ENGINEER required manufacturer located in Province of Quebec. Applicant should be approximately 25 to 35 years of age, bilingual and preferably married. Apply to File No. 4293-V.

SALES ENGINEER required in Montreal for contacting municipalities and contractors. Equipment consists of water and sewage piping, concrete blocks. Applicant should be recent graduate and bilingual. Excellent opportunities offered. Apply to File No. 4295-V.

SALES ENGINEER required for heating and ventilation equipment. Must have established industrial sales contacts in Montreal area. Apply to File No. 4296-V.

PRODUCTION CONTROL supervisor required immediately, capable of administering a large department comprising of the following divisions: material control, production control, stores, receiving and plant material transport. Large manufacturing company located in central Ontario. Permanent position for one who has the necessary qualifications. Apply to File No. 4293-V.

ENGINEER REQUIRED by large manufacturing company in central Ontario to act as correspondent for the export department. Applicant must be capable of handling correspondence from South America and have some experience with this type of foreign trade. Apply to File No. 4298-V.

INDUSTRIAL ENGINEER required by firm of consultants located in Montreal. Applicant should be 30 to 45 years of age with experience in management consulting or in industry. Apply to File No. 4299-V.

GRADUATE ENGINEER required by large manufacturer in Ontario. Applicant should have some experience in general plant maintenance problems and installations. Apply to File No. 4301-V.

SUPERVISOR MANUFACTURING methods and standards required by organization in Toronto. Applicant should have from 3 to 5 years experience in an industrial engineering department in a position of responsibility and should know present day motion-time systems. Apply to File No. 4302-V.

ENGINEERING SALES ESTIMATOR, young man required by leading electrical manufacturer for estimating, quotations and sales correspondence for our department of industrial fans. Basic technical background required, excellent opportunity. Apply to File No. 4303-V.

MECHANICAL OR ELECTRICAL engineer, recent graduate, previous experience not necessary, required by railway in Ontario. Will be given progressive training in various departments as a foundation for future engineering position in the mechanical department. This railway is almost completely dieselized and this is an excellent opportunity for the right man. Apply to File No. 4305-V.

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate, interested in following employment in illumination. Apply to File No. 4306-V.

METALLURGICAL, ELECTRICAL, Mechanical or Chemical engineer required by metallurgical plant located in Province of Quebec for production department. Salary for 1952 graduate $300.00 per month, for graduates with one or two years experience the salary is open for discussion. Applicant should be bilingual. Apply to File No. 4310-V.

FIELD ENGINEER required by manufacturer of premium quality industrial power transmission V-setting and drives, full range of specialized industrial hose and other mechanical rubber goods throughout industrial, mining, lumbering, paper and construction markets. Qualifications: preferably graduate engineer with minimum 1 year selling experience, owner of serviceable car. Based centrally in New Brunswick or Nova Scotia. Age 23 to 40. Apply to File No 4313-V.

SALES ENGINEER required by American manufacturer of industrial pumps, manufacturing in Canada. Territory Montreal and area. Age 25 to 35. Engineering degree and some experience in hydraulic field. Apply to File No. 4316-V.

ENGINEERS (grade 1 $2970.00-$3498.00) plus cost of living bonus of $907.00 per year, required by City of Montreal. Engineering or applied science degree from a recognized university, must be a member of The Corporation of Professional Engineers in P.Q. For further information apply to File No. 4317-V.

SANITARY ENGINEER Grade 3 ($4290.00-$4950.00) plus cost of living bonus $907.00 per year required by City of Montreal. Must have a degree in engineering or applied science from a recognized university and preferably experience in public health in matters of sanitation, preferably with a federal, provincial or municipal health department. For further information apply to File No. 4317-V.

A LEADING MONTREAL manufacturer of electronics equipment requires men with electronics design and development experience for an expanding program in the following fields, relay communications systems, VHF and UHF equipment, radar design and production, general electronics design and development. Please give full particulars of age, education and experience in reply. Apply to File No. 4318-V.

UNIVERSITY GRADUATE for research and development work on textiles for a Toronto research laboratory. Applicants should possess a degree in physics, chemistry or textile technology and have some experience in the field of cotton textiles. This position is suitable for a young man, preferably not over 30. Salary will be commensurate with qualifications and experience. Applications or requests for further information should state age and give full particulars of training and previous experience. Apply to File No. 4319-V.

SALES ENGINEER required by manufacturer of heating, ventilating and air conditioning equipment. Starting salary of $4000.00 plus commission arrangement would be considered. It is desired to find someone who can develop dealer outlets, dealer training in air conditioning survey work, and who can help prepare catalogues for specific items. A person around the age of 30 would be desirable, but age will not be considered a barrier. We prefer applications in writing stating previous experience, education and training, and if bilingual. Apply to File No. 4321-V.

REQUIRED FOR WORK IN MONTREAL OFFICE. Four graduate mechanical engineers and four senior draftsmen with not less than three years experience in detailed design of high quality machinery parts.

REQUIRED FOR FIELD WORK IN ONTARIO. One graduate mechanical engineer with not less than three years experience in the installation of machinery and other mechanical equipment. APPLY TO: Manager, C. D. Howe Company Limited, 1421 Atwater Avenue, Montreal, Que.

DESIGN ENGINEER required by Montreal manufacturer of air conditioning equipment. Graduate engineer of American or Canadian University acceptable. One who is fairly familiar with air conditioning and refrigeration applications, and a person capable of making cooling load surveys, quotations, air conditioning design and installation supervision. The salary will vary with the amount of experience. For person with minimum two years experience, starting salary of $4,000.00. Greater amount would be paid for person with extra capacity. Apply to File No. 4321-V.

SENIOR VACANCIES exist in all branches of the profession with the Hebrew Institute of Technology, Haifa, Israel. For all further details apply to File No. 4324-V.

ENGINEERS REQUIRED by expanding operations in Ontario, interested in aircraft engineering, sheet metal work. Apply to File No. 4325-V.

ESTIMATOR WANTED by well established general contractors located in Montreal. Must be bilingual and fully experienced and be capable of taking complete charge of estimating department. Salary open. All replies held in strictest confidence. Apply to File No. 4330-V.

ENGINEERS-IN-TRAINING for B.C. Forest Service. Salary $271-$327. Graduation from recognized university civil or forest engineering, or registered as engineer-in-training with Association Professional Engineers B.C. Promotion to high grades made when full professional registration completed. Positions permanent, superannuation plan. British subjects, under 45 years unless ex-servicemen. Apply to File No. 4331-V.

Situations Wanted

CIVIL ENGINEER and Land Surveyor, M.E.I.C., 26 years varied experience abroad and in Canada, in: railroad, airport, road, dam, water supply, irrigation, building, factory construction and related survey of layouts and locations. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. Apply to File No. 489-W.

CHEMICAL ENGINEER, B.Eng. McGill University, M.E.I.C., P.Eng., age 31, single, 7 years experience in development, control and production in pulp and paper industry. Presently employed in supervisory capacity. Desires responsible position with any organization located in vicinity of Montreal or Toronto. Apply to File No. 660-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec, Technical College, Stuttgart 1924, about 18 years experience in Canada in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area preferred. Apply to File No. 1862-W.

ELECTRICAL ENGINEER, P.Eng., M.E.I.C., 20 years experience includes approval and type test work; design of power and lighting layouts; electric and diesel electric railway work; heating and airconditioning contracting. Versed also in administration; cost estimating and accounting; sales. Desires position calling for any of the above experiences, especially if emphasis is laid on the practical execution of the assignments. Available on approximately one month's notice. Apply to File No. 2101-W.

CIVIL ENGINEER M.E.I.C. available extensive experience in administration and all phases of heavy construction. Location immaterial. Apply to File No. 2474-W.

MECHANICAL ENGINEER, available for responsible position offering opportunity as representative, plant or assistant engineer. Experience includes design, construction and maintenance. Good working knowledge of French and German. Reply to File No. 2642-W.

CIVIL ENGINEER, B.Eng. (McGill '44), M.E.I.C., P.Eng., P.Q., Ass. Member CPPA, 35, married, car, speak French. Experience: 3 years small tool manufacture; 18 months paper mill maintenance and construction; two years woodlands engineering for paper company on North Shore; over two years Assistant Woodlands Engineer for paper company in Central Quebec (including six months as resident engineer on a development project on the North Shore); just completed contract with U.S. Geological Survey on ECA loan to Directorate of Colonial Surveys in East and Central Africa. Desire work in woodlands or construction, or other, in Canada or abroad. Apply to File No. 2896-W.

Jr.E.I.C., P.Eng., Grad. McGill 1949, age 27, single. Extension courses in Business administration, experience in construction, surveying, municipal engineering works, estimation, costing systems, administration. Available on reasonable notice to present employer. Apply to File No. 2956-W.

Jr.E.I.C., P.Eng., grad. McGill 1949, age 27, single. Experience in design and construction of reinforced concrete and prestressed concrete, and multiple construction techniques. Familiar with construction costing systems. Available on reasonable notice to present employer. Apply to File No. 2956-W.

ELECTRICAL ENGINEER, B.Sc.E.E. P.Eng. (Ont.), 5 years experience in electrical manufacturing ,internal control and technical sales. Desirious of improving present position with greater scope of responsibility. Presently completing M.Comm. course at Varsity at nights. Completed marketing, and accounting and statistics. Apply to File No. 2975-W.

HEATING AND VENTILATING and electrical design services. Plans and specifications, by professional engineers. Apply to File No. 3120-W.

MANAGEMENT AND FIRE PROTECTION services surveys and reports by professional engineers. Apply to File No. 3120-W.

GRADUATE MECHANICAL ENGINEER with several years experience in operation of plant seeks change of position to one requiring initiative and ability to accept responsibility at the executive level. Location preferably Quebec province but would go elsewhere in Canada dependent on nature of position offered. Apply to File No. 3355-W.

CIVIL ENGINEER, M.Eng., Jr.E.I.C., P.Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement. Montreal area preferred. Apply to File No. 3466-W.

CIVIL ENGINEER, with eight years general field experience obtained on Hydro-Electric construction, age 32, married, B.S.C., Jr.E.I.C., P.Eng., have attained responsible status; desire employment in Ontario or the West with small construction firm with eventual interest in business; presently working in isolation location. Apply to File No. 3604-W.

CHIEF INDUSTRIAL production engineer, age 38, graduate engineer, British A.M.I. Mech.E., A.M.I. Prod.E. 1st class, C.G.C. (Honors) 24 years experience, apprentice trained, requires executive position. Diesel, automobiles, gearing machine tools, industrial consulting, covering a comprehensive field in all phases of works and production management with world famous companies. At present employed with well known Canadian company in the capacity of job engineer. Principals who can offer a highly responsible position with genuine prospects of advancement, commencing salary being of secondary importance, apply for further particulars to File No. 3617-W.

YOUNG MECHANICAL ENGINEER Jr. E.I.C., P.Eng., single, over 5 years design experience in process industries (mostly pulp and paper), power and construction, desires a responsible position offering a genuine opportunity for initiative and advancement. Available on two weeks notice to present employer. Personal interview by appointment. Montreal preferred. Apply to File No. 3777-W.

CIVIL ENGINEER, University of Saskatchewan, 1951 Jr.E.I.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

YOUNG ENGNEER, S.E.I.C., B.A.Sc., chemical engineering, fully bilingual, desires position around Montreal, either in sales or in design. Very interested in the heating and ventilating field and also possessing some industrial experience. Apply to File No. 3928-W.

CIVIL ENGINEER B.S.E. University of Michigan, Canadian citizen. Varied experience in estimating and project management, some purchasing with medium size contractor. Desires similar work in Montreal, Ottawa, or Hamilton area. Apply to File No. 3960-W.

MECHANICAL ENGINEER Jr.E.I.C., McGill 1950, recently completed two year graduate student engineering course with a large electrical manufacturer. Primarily engaged in plant layout, plant engineering and methods. Age 32, married, ex-naval officer seeks employment in manufacturing, preferably with a smaller company. Apply to File No. 3961-W.

PART TIME WORK desired by graduate electrical engineer, power option. S.E.I.C., P.Eng. (Ontario). Evenings and week-ends in Toronto. Experienced in wiring design and lighting layout work. Apply to File No. 3962-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I. Mech.E. (G.B.), M.E.I.C., P.Eng. 20 years experience in development various types high speed I.C. engines (carburettor, diesel, petrol-injection, supercharged etc. from 20-1,000 hp.). At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. Apply to File No. 3863-W.

MECHANICAL ENGINEER, Jr.E.I.C., N.S.T.C. (1949), single, age 26, two years experience in technical and engineering departments of large Canadian chemical firm and one year in the pulp and paper industry. Desires employment in industrial engineering work. Apply to File No. 3966-W.

ELECTRICAL ENGINEER, U.B.C. 1947, Jr.E.I.C., P.Eng., age 28. Experience: one year test course, three years design and manufacture of control equipment, one year abroad in design office of a public utility. Desires responsible position. Available immediately. Apply to File No. 3967-W.

CHEMICAL ENGINEER, graduate of University of Toronto, 1950. Married, presently employed by nationally known firm in the industrial engineering field. Interested primarily in position in either production or sales in Eastern or Western Canada, Western Canada preferred. Desires only a position where hard work and initiative will bring advancement. Available on short notice. Apply to File No. 3968-W.

QUALIFIED ELECTRICAL and mechanical engineer, aged 28, M.E.I.C., graduate of the Institution of Electrical Engineers, graduate of the Institution of Mechanical Engineers, U.K. Emigrating to Canada in June, 1952, experienced in organization and supervision of electrical transmission schemes up to 132KV. Also general industrial electrical installations. Seeks opportunity preferably with consultant, contractor or supply company but prepared to consider work in any field of electrical or mechanical engineering anywhere in Canada. Any reasonable offer considered. Apply to File No. 3969-W.

GRADUATE CIVIL ENGINEER Jr.E.I.C., 5 years experience in pulp and paper industry covering design, construction and plant engineering. Also experience in technical and economic evaluation of new developments for management and supervision of small project staff. Desire broader opportunity in pulp and paper or chemical field. Location irrevalent. Apply to File No. 3970-W.

CHARTERED MECHANICAL ENGINEER British subject holding major English qualifications is now available in Toronto and is anxious to contact Canadian principals with a view to taking up a permanent position at the earliest possible moment. Twelve years practical executive experience in the layout and equipment of large shops, garages and depots. Accustomed to the control of administrative, technical and shop staffs. Considerable experience of both design and estimating of all such equipment and services, including shop layout, pipe services, conveyors, cranes and other lifting equipment. Fullest knowledge in the preparation of specifications and reports, accustomed to dealing with purchasing staffs in connection with the placing of contracts. Highest references from Canadian and English executives to those interested. Apply to File No. 3974-W.

MECHANICAL ENGINEER, Jr.E.I.C., 1950 honour graduate, one year's training in administration and supervisory work, and one year's experience in design of conveying equipment. Interested in design or production work, and also in employment in plant engineering or materials handling department of production organization. Available on short notice. Location irrelevent. Apply to File No. 3975-W.

MATHEMATICIAN, age 40, German, recently immigrated, Dr. rer. nat. Technical University Berlin, more than 10 years activity in responsible industrial, governmental, and University positions. Good experience in all branches of numerical analysis, in mechanics (ballistics, aerodynamics) and in theoretical physics. Various scientific publications. Own computing machine. Desires position in industrial company or research institute where mathematical knowledge and abilities are required. Willing to accept starting position with future possibilities. Available immediately. Apply to File No. 3977-W.

PHYSICIST, German, age 49, married, 4 children, 1930 promoted to Dr. phil. in physics at the University Leipzig (Germany). Presently located in Canada. Sound knowledge in experimental physics and mathematical calculation of the measurements. Worked as physicist for research work and development. Desires starting position in Physical laboratory, research work, test or instrument engineer. Prefer cable, metallurgical, or chemical industry anywhere in Canada. Available immediately. Apply to File No. 3978-W.

TWO YOUNG CIVIL engineers presently located in Montreal with six years' experience in reinforced concrete and steel construction, desire part time employment (evenings and week-ends) doing calculations and drawings. Apply to File No. 3979-W.

CIVIL ENGINEER, M.E.I.C., P.Eng., B.Sc., Manitoba 1944. Age 29, married, two children, veteran R.C.A.F. Extensive experience in design of reinforced concrete and foundations; plant layout and mechanical design in Mining, chemical, and paper industries; checking field construction and estimating. Desires a position as plant engineer or with a consultant, preferably in Ontario. Apply to File No. 3980-W.

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

SALES ENGINEER OR MANAGER, P.Eng., M.E.I.C., A.I.P.E., B.A.Sc. (Mechanical) Toronto 1943, age 32, married, presently in Ottawa but free to locate anywhere and willing to travel. Fourteen years total training and experience, last seven with same employer, last three as district manager in charge of all operations. Accustomed to dealing with executives, professional people and federal government officers. Desire to represent manufacturer of specialty mechanical and electrical equipment or related work. Apply to File No. 3982-W.

ENGINEER M.E.I.C. P.Eng. 30 years experience with competent designers and detailers associated, specializing in the efficient preparation of preliminary studies, designs, detail drawings, specifications and supervision of construction for small and large industrial buildings and miscellaneous structures. Desires to act as consulting engineer for individual parties or companies requiring industrial building development in the Maritimes, and Eastern Canada. Apply to File No. 3983-W.

ELECTRICAL ENGINEER, Jr.E.I.C., graduated 1950 desires employment with responsibility and opportunity. One year's experience in power apparatus sales, including substation layouts: 4 years as radar officer in R.C.A.F.; 5 years in telephone industry including both inside and outside maintenance and equipment engineering work. Married age 31. Apply to File No. 3984-W.

CIVIL ENGINEER S.E.I.C., (McGill '52) desires to work for a contractor or a consulting firm doing concrete or structural design of buildings. Apply to File No. 3988-W.

PLANT ENGINEER'S POSITION WANTED, M.E.I.C., 37 year old maintenance supervisor of a chemical industry desires more responsibility and scope. Have had special experience in labour controls and preventative maintenance which produced a substantial reduction of costs. Engineering background is mechanical and electrical. Desire position paying upper level of professional engineers of Ontario grade V salary schedule. Apply to File No. 3989-W.

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

B.SC., A.M.I.E.E., English, age 27, emigrating to Canada later this year, desires post in which initiative and ability may be exercised. 8 years' experience design and development electronics, cables, transformers and mercury pool rectifiers. Some sales experience. Past 2 years spent on application of mercury pool high frequency inverters to induction heating for both forging and melting of metals. Location not important. Apply to File No. 3995-W.

CIVIL ENGINEER, Jr.E.I.C., 1950 graduate desires part time work in Montreal evenings and weekends detailing concrete reinforcing including bar lists, quantity take-offs, etc. Apply to File No. 3996-W.

ELECTRICAL ENGINEER, University graduate, 40, British, A.M.I.E.E., desires progressive position in Canada. Good education, wide general knowledge, experience in design and testing of electrical machines, plant maintenance, electric traction, operation of thermal and water power stations, commercial operations and in particular organization and administration of electric utility. Adaptable, widely travelled, fluent French and several other languages. Apply to File No. 3997-W.

AGRICULTURAL ENGINEER, M.E.I.C., Sask. 1943. Experience includes production, maintenance and plant expansion and construction. With D.I.L. one and half years, large food processing firm five years and dehydration firm three years. Available on short notice. Desire position with greater responsibilities and good future. Apply to File No. 3998-W.

CIVIL ENGINEER, M.E.I.C., commissioned Dominion Land Surveyor, soon to be retired from the federal civil service, graduate of Queens 1914, feels thoroughly fit for many more years service, in a supervisory capacity. Experience of over 40 years in the surveying profession, comprising legal and subdivision surveys: mapping by plane table and aerial photographs; road construction and townsite layouts; extensive knowledge of computing ground control for aerial mapping and reconnaissance. Apply to File No. 3999-W.

GRADUATE ENGINEER, B.Eng., S.E.I.C. (mining) McGill 1951, age 28, married, presently employed as layout engineer with large base metal mining company, seeks opening where initiative, capability and ambition would lead to position of technical or supervisory responsibility. Experience includes three years R.C.A.F., two summers military engineering (roads and bridges), varied experience in surveying, both topographic and underground, and underground mining. Presently enrolled in business management course, LaSalle Extension University. Interested in administration, report writing, planning. Apply to File No. 4000-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc., University of Alberta 1948, P.Eng., age 31, 2 children. 2 years industrial training course, 1 year engineering on specification of materials and processes, 1 year engineering on automatic home laundry equipment. Would like to return to Alberta or Western Canada. Interested in all phases of engineering including manufacturing, sales and service work. Apply to File No. 4001-W.

CIVIL ENGINEER, M.E.I.C., graduate 1949, age 27, married, one child. Desires position with opportunity for experience and advancement, preferably in Western Canada. 3 years varied experience in design and construction. Apply to File No. 4002-W.

PART TIME WORK, desired by civil engineer, M.E.I.C., evenings and week-ends in Montreal. Experienced in structural design: reinforced concrete, steel, wood. Calculations and drawings. Plant layout. Apply to File No. 4303-W.

ELECTRICAL ENGINEER, age 25, double graduate with first class honours degrees in Pure Science (physics, mathematics) and in electrical engineering; graduate of the General Electric Test Course in Schenectady (58 weeks) and with 1½ years experience in well-known electric power concerns and utilities in Canada and overseas; desires a suitable position. Energetic with initiative and ability to pick up new aspects. Willing to travel and work anywhere n Canada or overseas. Apply to File No. 4011-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1949) age 30, single, R.C.A.F. veteran. Three years assistant city engineer in an Ontario city. Desires position with future utilizing municipal experience ,anywhere in Canada. Available 1953. Apply to File No. 4012-W.

CHEMICAL ENGINEER, Jr.E.I.C., graduate Toronto, 1950, married, age 34, ex-serviceman, 21 months experience as assistant plant manager in English titanium pigment manufacturing company, desires good opening in Ontario. Experienced in both production supervision and investigation of a wide variety of problems. Fifteen months vacation experience with a Canadian oil company. Available for interview after October 19th. Apply to File No. 4013-W.

ELECTRICAL ENGINEER, S.E.I.C., McGill 1951, P.Eng., Quebec, age 24, also graduate of Canadian General Electric Test Course. Presently employed with large manufacturer, desires job with greater responsibility and with a definite opportunity for advancement. Location of secondary importance. Available on several weeks notice. Apply to File No. 4014-W.

CIVIL ENGINEER, P.ENG., M.E.I.C., B.A.Sc., 1942, age 38, single. Varied experience, field and office, large construction projects including logging operations, highway and airport construction, housing, docks, pulpmill. Desire responsible assignment as superintendent, project engineer, assistant plant engineer in construction or manufacturing organization. Position must require initiative, drive and executive ability. File No. 4015-W.

ELECTRICAL ENGINEER, P.Eng., Jr. E.I.C., 1948, B.Sc., in electronics. Graduate of test course of large electrical manufacturer, two years experience in testing and erection of equipment. Desire position with smaller manufacturer or consulting firm. Apply to File No. 4022-W.

ADMINISTRATIVE EXECUTIVE AVAILABLE. Advertiser desires administrative position in Montreal that will utilize his ability to organize and supervise, write clear reports, and maintain good public relations. He is a Civil Engineer, 31 years old, married, bilingual, and a born Montrealer. He has had considerable experience with government agencies in the construction and management of large housing projects, but would prefer now to enter into private enterprise. Apply to File No. 4023-W.

CHEMICAL ENGINEER, McGill University, 1950, Jr.E.I.C., O.A.P.E., 31, R.C.A.F. veteran, married. Presently employed by Ontario textile firm, doing laboratory work. Apply to File No. 4024-W.

MECHANICAL ENGINEER, S.E.I.C., one year experience in production, several months general engineering in paper and allied industry, presently employed desires change location. Bilingual, married. Apply to File No. 4025-W.

CIVIL ENGINEER, A.M.I.C.E., Ph.D. (Imperial College in London), 36, wishes to contact prospective employers in connection with his pending immigration to Canada. Specialist in advanced design including shell structures and prestressed concrete. 13 years of experience in industry, research and university lecturing. Apply to File No. 4026-W.

News of the Branches

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

Halifax

W. E. Jefferson, M.E.I.C.,
Secretary-Treasurer

Special Course

The Halifax Branch of the E.I.C., in keeping with the ideas and suggestions as set forth in the Monteith Report, has this year embarked upon a program of lectures designed to assist and promote the interest of the new graduate in his professional development.

Last fall a committee under the chairmanship of W. A. Devereaux, M.E.I.C. was appointed, and the prodigious task of organizing a series of lectures was commenced.

The junior engineers of the Branch were circularized, and this resulted in sixty-one persons indicating their desire to take part in such a course. The membership fee was set at $5.00, and the only prerequisite for membership in the course was that the individual must be an engineering graduate and a member of either the E.I.C. or the A.P.E. (N.S.).

The committee was faced with the usual many and varied problems which are so typical in the organization of such a series of lectures, i.e. the subjects, the lecturers. Also, due to the fact that the course was late in getting under way, and with the limited time available, the problem of selecting subjects which would be most advantageous and encouraging to those attending the lectures, proved to be an arduous one.

Fortunately, through the kindness of the University of King's College, and the Nova Scotia Technical College, no problems were encountered in obtaining the use of lecture rooms for the weekly classes.

In Halifax the program has been a very general one, dealing only with non-technical subjects. Over the three month period during which the course extended, the following subjects were covered:

Effective Speaking — three lectures; Human Relations in Industry — two lectures; Personnel Administration—one lecture; Labour Relations — three lectures; Contract Law — two lectures; Business Administration — one lecture; Industrial Accounting — one lecture.

The method that has been adopted is to have the lecturer speak for about one hour. Then the members divide themselves into groups, appoint a group leader and discuss the lecture. The group leaders then reconvene and submit the ideas and opinions as presented by their group. This is usually followed by a general discussion period.

The results that have been achieved by using these methods are quite satisfactory, judging on the basis of general interest, discussion, and high average voluntary attendance.

The committee in charge of the Special Course is comprised of: W. A. Devereaux, chairman; R. W. Hodgson, secretary; and Dr. F. H. Sexton, Prof. M. L. Baker, J. D. Baig, W. J. Phillips, and G. D. Mader.

This committee has been appointed by the executive of the Halifax Branch which is under the chairmanship of J. W. MacDonald, M.E.I.C., and with W. E. Jefferson, M.E.I.C., Secretary.

Some members of the committee which arranged the lecture course for the Halifax Branch: left to right, Prof. M. L. Baker, G. D. Mader, J. D. Baig, and R. W. Hodgson, secretary.

Prof. W. R. Berman, assistant professor of commerce at Dalhousie University, lectured on industrial accounting. R. F. Tanton (right) was chairman and G. W. Frey (left) introduced the lecturer.

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Branch News Editor

July Meeting

At a meeting of the Vancouver Branch held in the new Engineering Building, University of B.C., on July 22nd 300 members and their guests had the privilege of hearing an address by Dr. Carl Terzaghi, international authority on soil mechanics.

Branch Chairman S. H. de Jong presided and the speaker was introduced by Mr. P. S. Radley, M.E.I.C., manager of the Alcan Project in B.C.

Speaking on the subject "Earth Dams —Design and Construction", Dr. Terzaghi mentioned that the first known dam was constructed at the beginning of the Christian era in Ceylon, India. Many earth dams which were later built in other parts of the world on the same 'trial and error' basis ended in failure without the cause of failure being fully known.

This situation continued until as recently as 30 years ago, but since then important discoveries in respect to soils have led to the use of the principles of applied mechanics in the design of earth dams.

Using lantern slides Dr. Terzaghi illustrated with charts the relation of water content to dry density, porewater pressure effect, resisting moments due to friction and results of soil compaction.

Drawing from his store of experiences on earth dam construction throughout the world he described in general terms some of the problems in the design of both homogeneous and core dams.

At the conclusion of his address Dr. Terzaghi answered a few questions, after which the chairman called upon H. N. McPherson, M.E.I.C., who very ably conveyed to the speaker the appreciation of the Branch.

Winnipeg

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

Visit To Pine Falls

Members with their wives and guests of the Winnipeg Branch and the Brandon section were guests of The Manitoba Hydro-Electric Board at its Pine Falls Development on May 11. The party left Winnipeg by special train at 9.00 a.m. arriving at the site at 11.00 a.m. Mr. J. R. Rettie, projects engineer for the Board, divided the party into groups of approximately twenty, each group, with a guide, touring the plant until 1.00 p.m.

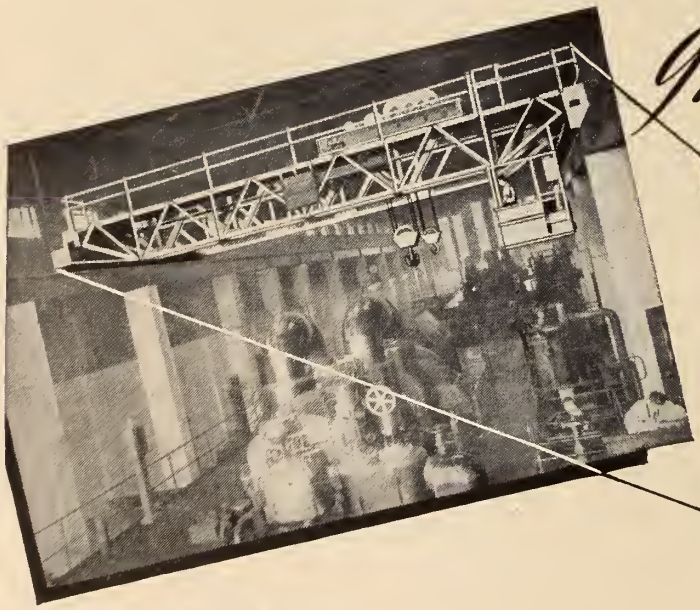
The visitors were guests of the Board for luncheon at the plant. Major J. L. Charles, vice-chairman of the Branch, introduced Mr. D. M. Stephens, chairman and general manager of The Manitoba Hydro-Electric Board, who welcomed the group to the project. Mr. Stephens paid tribute to the excellent work of the many engineers in the Province who were concerned either directly or indirectly with the Pine Falls Development. Mr. T. E. Storey, assistant general manager of the City of Winnipeg Hydro-Electric System, expressed the appreciation of the members and their guests to the Board for the opportunity of visiting this plant in its final stages of completion.

The most striking thing about this plant is the compactness and simplicity of the layout. In general equipment is of the latest type and many new trends in design are apparent. When one considers the high river flows and adverse weather conditions encountered during its construction it must be said that the Pine Falls plant is a truly remarkable engineering achievement.

During the past year the Branch has had two very excellent papers presented on this project by Mr. D. W. Miller and Dr. F. G. A. Tarr.

Mr. Miller, resident engineer for H. G. Acres and Company, consulting engineers for the Board, presented a paper on November 29th, 1951, entitled "Investigation of the Site and Cofferdam Utilization and Construction". This paper was well illustrated by slides and a film portraying various stages of the construction of cofferdams. Mr. Miller outlined the method of sounding used to determine the river bottom contours prior to the selection of the site. He also graphically illustrated the unique method used in flat angle diamond drilling under the river bed to determine the bedrock conditions.

The second paper, by Dr. Tarr of the Electrical Department of H. G. Acres and Company, presented on April 17th, 1952, dealt with the electrical installa-



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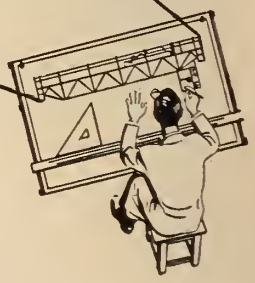

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tion at Pine Falls. Dr. Tarr illustrated this paper very well with slides. He fully described the double ring bus method used in tying in the plant to the Manitoba Power Commission and the Winnipeg Electric Company power systems. He also described the main equipment installed and the extensive system of relay controls and protection utilized in the plant.

Electrical Section

J. G. Dickinson, M.E.I.C.,
News Editor

Visit To Seven Sisters Plant

Members of the Electrical Section, Winnipeg Branch, and their ladies were very graciously entertained at the Winnipeg Electric Seven Sisters Hydro Electric Plant, Saturday, July 5th. About sixty persons took advantage of the very bright warm day to leave the city and spend it in the pleasant surroundings at Seven Sisters. The name of the site incidentally is derived from the series of rapids originally called Seven Portages, as pointed out by Mr. K. C. Fergusson who is superintendent of Winnipeg Electric Company Power Plants.

Transportation was provided by the Winnipeg Electric Company transit system. The Ladies' Auxiliary at Seven Sisters served a splendid lunch.

After lunch an ably conducted tour was made of the plant. The guides did such a grand job that many of the ladies, after the tour, talked of generating capacity, forebay elevation and head, just as if they were everyday topics of conversation.

In addition there happened to be a diver preparing for some underwater work and needless to say he had a large audience. Another unit, No. 6, to be exact, is being installed, with the result that many saw construction and equipment in process that they hadn't seen before. For example, the rotor was being stacked and the stator coils were being inserted.

Some very interesting history of the Winnipeg River was given by Mr. Fergusson after lunch. He recalled many of the original names given by La Verandrye Jr., when that voyager journeyed down the Winnipeg River from Lake of the Woods to Lake Winnipeg where he was met by his father who had taken the southern route to Lake Winnipeg via the Red River. Two names come to mind, Grand Du Bonnet falls, the present site of Great Falls Power Plant and of course Seven Portages, now Seven Sisters. He described how it was that Pinawa, the first hydro power plant on the river, being built in 1902 was closed down in the fall of 1950 to allow a greater head at Seven Sisters. The Pinawa plant of 30,000 hp. was on a branch of the Winnipeg River emptying into Lac Du Bonnet from whence it joined the main channel. At the time of its construction Mr. Ferguson said it was a much greater task than the building of the huge Seven Sisters plant of 225,000 hp. ultimate in 1929.

The nominal head at Seven Sisters is 66 ft. The forebay covers an area of approximately 10,000 acres. By means of an air bubbler system ice is prevented from forming along the dam and of course relieves the forbay ice pressure on it. The turbines are 6 blade propeller type. Power is transmitted at 110 kw., one line to Kenora, four to Winnipeg and two tie lines with the Great Falls Plant. Few realized that Seven Sisters is the site of the largest hydro electric generating station in the Prairie Provinces.

Mr. A. S. Williams, superintendent of Seven Sisters Plant and the Winnipeg Electric Company was assured of the appreciation of the Section for a very enjoyable outing.

Hamilton Branch—Annual Ball

Hamilton and Toronto Branch members are urged to note that the Annual Dinner and Ball of the Hamilton Branch is scheduled for Thursday, October 16. At that time the Branch will greet the President of the Institute and his party. A good program, with professional entertainment, will be provided for the Dinner and Ball, at the Brant Inn, Burlington, Ont.

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BOOK NOTES

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The artificial satellite: the proceedings of the second international congress on astronautics, London, 1951. L. J. Carter, ed. London, British interplanetary society, 1952. 73 pp., illus., $0.75.

The present booklet contains six papers presented by members of the society and dealing with the following aspects of the artificial satellite problem; interplanetary travel between satellite orbits, descent from satellite orbits using aerodynamic braking, meteor hazards, establishing contact between orbiting vehicles, etc. Summaries of eleven papers presented by members of other societies are also given. Included are a list of societies interested in space-flight and information on the British interplanetary society. The book contains a few photographs, drawings and diagrams.

The co-operative movement and some of its problems. P. H. Casselman. New York, Philosophical library, c1952. 178 pp., $3.60.

The twelve chapters of this book cover the following aspects of the co-operative movement: the ideals and principles of co-operation; attitudes towards cooperation and schools of cooperation; steps in the establishment of a cooperative economy; education in the cooperative movement; cooperatives and the state; cooperatives and labor; cooperatism and socialism; producer-consumer cooperative relations; cooperatives and taxation; the need for cooperation. In this work, Professor Casselman, of the University of Ottawa, brings the deeper implications of the cooperative movement to the attention of cooperators who, involved in the immediate problems of their particular societies, are prone to leave them to top-level thinkers. This is done in a popular style of writing. An index and an exhaustive bibliography are included.

Elementary heat power, 2nd ed. H. L. Solberg and others. New York, Wiley, c1952. 624 pp., illus., $7.80.

The present work contains chapters on the following subjects: matter and energy; fuels and combustion; internal-combustion engines; fuel-burning equipment; steam generation; steam power-plant cycles; steam turbines; steam engines; pumps; drafts, fans, blowers and compressors; feed-water heaters and condensers; the gas-turbine power plant; mechanical refrigeration. It has been written to meet the following objectives: to develop in the student an understanding of the functions, principles of construction and actual performance of heat-power machinery, to provide an adequate and balanced terminal course for those students who do not study engineering thermodynamics and to provide a background for the testing of heat-power equipment in the laboratory. It contains a great number of problems with or without solutions, a short bibliography, an index and adequate illustrations.

Gears: spur, helical, bevel and worm. P. S. Houghton. London, Technical Press, 1952. 408 pp., illus., 50/–.

In drafting this book, the aim of the author has been to present the information relative to the various classes of gears in a manner which will be of value to the draughtsman working on the board, the shop superintendent and foreman, the mechanic in the fitting or repair section, the personnel in the inspection department and the student taking courses in engineering subjects. Chapters deal with types of gears, spur gears, cycloidal tooth form, gears for small mechanisms, value of helical gears, bevel gears, worm gears, internal gears, gear blanks, gear material, cutting gears, finish, inspection, production. A bibliography, an index, many tables, and an adequate number of illustrations are included.

Heat. R. C. Brown, Toronto, Longmans, 1952. 270 pp., illus., $2.70.

"Heat" is the second volume of a textbook of physics intended for British intermediate and general certificate of education (advanced level) students. At this elementary stage a large part of the quantitative treatment of heat can be done without the use of the calculus. Proofs of one or two equations which do require the calculus and might be regarded as coming within the scope of such a course on heat are placed in appendices. Problems are given at the end of each of the fifteen chapters. This work is illustrated and indexed. There is no bibliography.

Introduction to electrical engineering, 2nd ed. R. P. Ward. New York, Prentice, 1952. 412 pp., illus., $6.75.

This is the outcome of notes used by the author to teach the first course in electrical engineering at the Agricultural and Mechanical College of Texas. This course is given to first-semester second year students in electrical engineering who are taking, at the same time, their first

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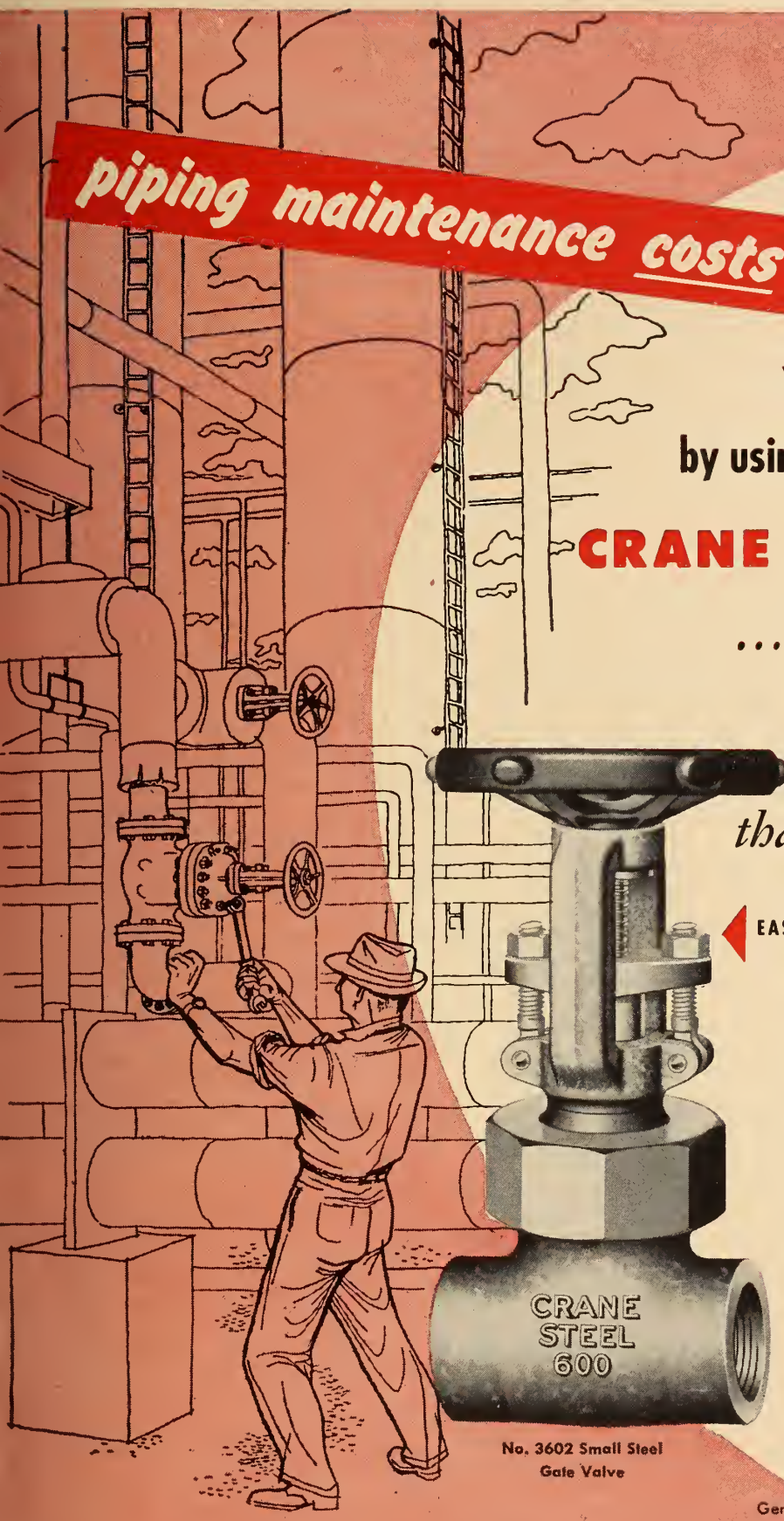

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courses in calculus and college physics. The mathematics used in the text is, therefore, limited in the earlier chapters to algebra and trigonometry, the concepts of rate of change and derivative being introduced later, in the chapter on electromagnetic induction. Derivations using calculus have been, for the most part, placed in footnotes in order that the main text might be followed by students not taking calculus. Illustrations, an index and hundreds of problems are included.

Mechanics of vibration. H. M. Hansen and P. F. Chenea. New York, Wiley, London, Chapman, c1952. 417 pp., illus., $9.60 (Canada).

This book has arisen out of a course in vibration analysis which has been given for several years by the department of engineering mechanics of the University of Michigan. Its aim is to present the fundamentals and basic theory in a manner readily understandable by the undergraduate, and yet acceptable by the graduate student. An effort has been made to present the theory in such a manner that it can be extended with ease to all the various problems which the practicing engineer has to solve. Many problems have been included. They are graduated in difficulty to increase their value as a medium through which to master the theory. Answers to these problems are given in an appendix. Illustrations and a short index will be useful to the student.

Principles of lighting. W. R. Stevens. London, Constable, Toronto, Longmans, c1951. 482 pp., illus., $7.00.

This is a presentation of the principles underlying different types of lighting installation and to exemplify them by current good practice. The earlier chapters cover, in a condensed form, the bulk of the information available on matters as essential as photometry and colorimetry. The rest of the book deals with lighting methods applied to such structures as offices, factories, etc. No detailed solutions of problems are given, interest being centered rather on methods of solution than on the answers. The many photographs, the detailed index and the bibliography will enhance the usefulness of this text to the reader.

Productivity and probability. T. F. O'Connor. Manchester, Emmott, c1952. 193 pp., illus., 5/–. (Mechanical world monograph No. 65).

In this mechanical world monograph, the author has attempted to deal logically with time study and incentive schemes based on time study. He has tried to bring light into such aspects of time study as rating, allowances, the definition of standard time and allowed time and the derivation of one from the other, the share factor, the problem of interference and bonus schemes. Some tables and a few pages of text from H. Ashcroft's paper "The productivity of several machines under the care of one operator" have been included. A few references to books on time study are also given.

A reference handbook for construction engineers, architects, builders, superintendents of construction and building construction foremen. H. G. Richey. New Orleans, Richey, c1951. Various paging, illus., $12.00.

While this is an every day reference book for the use of persons in charge of construction operations, it is also intended for the use of architects, builders, inspectors and others engaged in the supervision of building operations. Among other subjects, chapters deal with foundations, waterproofing, brick, stone, cement, concrete, fireproofing, roof work, carpentry, plastering, painting, plumbing, heating and ventilation, electric wiring, etc. Five chapters at the end of the book give theoretical data and useful practical hints on such subjects as hydraulics, strength of materials, drawing, laying out work, ornamentation. Illustrations, a detailed index and a twenty-six page glossary of engineering, architectural and trade terms further the usefulness of this handbook.

S A E manual on shot peening. Society of automotive engineers. New York, the society, 1952. 45 pp., illus., $3.00.

Pointing out possibilities and limitations of the shot peening process, this manual is intended as a practical aid to engineers, designers and men in the shop. Shot peening may be defined as the process of cold working the surface of a structural or machine part, by means of a driven stream of hard shot. Its purpose is to improve the fatigue properties of a steel part. The present work gives short chapters on the process, the machines used, work handling, the shot and its effects, production procedures, intensity measuring equipment, stabilization, masking, supporting fixtures, etc. Examples of typical methods in current use are given. Illustrations and an extensive bibliography are included.

Selling to industry. Bernard Lester. New York, Industrial press, c1952. 255 pp., $4.20.

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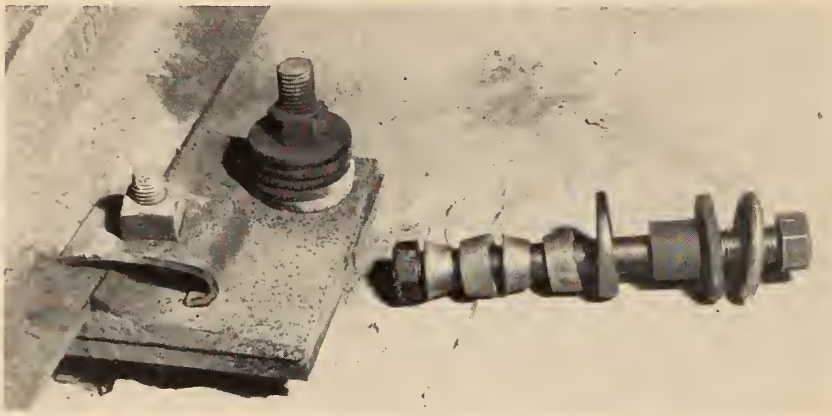

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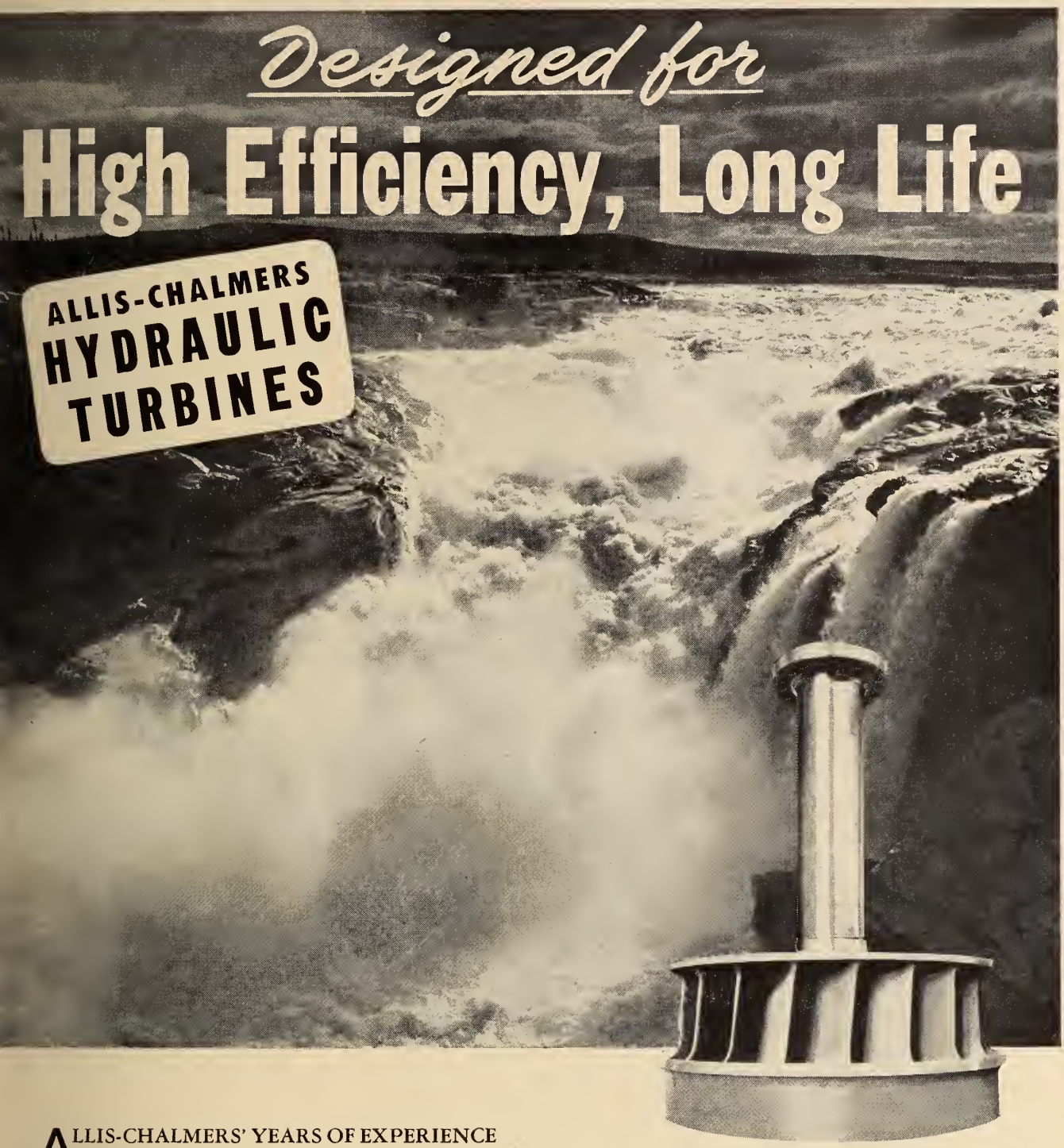

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in selling not being a haphazard affair, proper preparation is necessary. Hence this book attempts to set forth in a brief and realistic way those key points that have from experience been found to be most effective. Several sections of thst text have appeared, in modified form, in the magazine "Machinery". The author uses brief case histories to illustrate his points, describes specific situations, and discusses methods of handling them.

Steam power plants. A. H. Zerban and E. P. Nye. Scranton, Pa., International textbook, Scranton, Laurel, 1952. 524 pp., illus., $9.00.

This text is intended for junior or senior students in mechanical and electrical engineering who have done some previous work in heat power. Its purpose is threefold: to show the application of fundamental principles of science in heat-power engineering; to bring to the attention of the student the economic factors that influence engineering decisions; to give the students a general picture of the equipment of representative manufacturers. A simple and thorough coverage is given of heat transfer exemplified by the steam generator, and information on meters and controls add an unusual feature. A brief treatment of internal combustion units affords a means of comparison of their performance. Problems and lists of references are given at the ends of chapters; appendices contain tables and special problems, and the book is indexed and illustrated.

The supply of water. 2nd rev. ed. T. H. P. Veal. London, Chapman, Toronto, British book service, 1950. 276 pp., illus., $5.00.

The object of this work is to present in as brief a manner as possible the best available information concerning subjects, which, although of great importance to waterworks engineers, are ignored or only sparsely discussed in the ordinary textbook on hydraulics. These subjects include hydrology, the design and construction of reservoirs, layout of distributing systems and the purification of water. The main function of this book is to instruct the student and the young engineer, although it may, in some cases supplement the knowledge of fully experienced engineers. The illustrations, the index and the short bibliographies at ends of chapters will be helpful to the reader.

Technical publications 1949. Standard oil company (New Jersey) and affiliated companies. New York, Standard oil development company, Toronto, Imperial oil, c1951. 563 pp., illus.

The twenty-four articles reprinted in this fourth volume of "Technical publications", and the list of other papers published in technical journals during 1949 by members of Standard Oil Company (New Jersey) and affiliated companies, will give the reader some idea of the diversity of the technical problems which confront the petroleum industry. These articles deal with geology and production, manufacturing, physical chemistry and analysis. They are illustrated through photographs and diagrams and give lists of references. They will be useful to young scientists and engineers who are considering one of the many interesting phases of petroleum technology as a career.

La vibration du béton. G. Barcelo. Paris, Eyrolles, 1952. 219 pp., illus., 1,300 fr.

The original edition of this work on vibrated concrete was written in Spanish in 1947. Chapters deal with the importance and evolution of vibration, fundamental properties of reinforced concrete, aim and advantages of vibration, compaction, texture, composition of reinforced concrete, proportions of water and cement, size of aggregates, forms, theory of vibration, means of vibration, vibratory apparatus, and indirect, direct and internal vibration. The book also contains twenty pages of tentative recommendations on vibrated concrete construction, and an extensive bibliography.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Advanced antenna theory. (Applied Mathematics Series). A. Schelkunoff. New York, Wiley, 1952. 216 pp., illus., $7.80 (Canada).

This rigorous mathematical analysis of recent developments in antenna research stresses physical interpretations of the mathematical methods employed. The six chapters deal respectively with spherical waves, mode theory of antennas, spheroidal antennas, cylindrical antennas, integral equations, and natural oscillations. Special attention is paid to Hallen's asymptotic solutions for thin antennas, Stratton and Chu's solution for spheroidal antennas, and the author's own theory of conical antennas and thin antennas of arbitrary shape.

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Analytical mechanics for engineers. F. B. Seely and N. E. Ensign. New York, Wiley, fourth edition, 1952. 443 pp., illus., $6.60 (Canada).

The principles of mechanics that are essential for engineers are presented in four sections: statics; kinematics; kinetics; and the special topics of vibrations and balancing. The intention is to develop these principles from common experience, to apply them to practical problems, and to emphasize their physical interpretations. New illustrative problems have been added, and the material has been revised in accordance with current ideas to provide a more logical presentation.

Antennas: Theory and Practice. (Applied Mathematics Series). S. A. Schelkunoff and H. T. Friis. New York, Wiley, 1952. 639 pp., $12.00 (Canada).

This comprehensive treatment of the basic ideas and techniques necessary for an understanding of antenna behavior combines a discussion of antenna principles and the theory of radiation with practical applications. It begins with a broad survey of the entire field, develops and applies the essentials of field theory, considers spherical waves on wires and in free space, and deals with directive radiation and its application to antenna arrays. Power transmission between two antennas and the quantitative theory of wave propagation are discussed. Practical information is given on all types of antennas.

Four-place influence line tables for movments, shears and reactions. Gustav Griot. Transl., rev. and enl. by H. G. Lorsch. New York, Frederick Ungar, 1952. 87 pp., $4.50 (Canada).

These four-place influence line tables are usefully employed to reduce greatly the calculating work required for the analysis of continuous beams under dead and live loads. There is a detailed explanatory introduction with numerical examples.

Introduction to electronic circuits. R. Feinberg. Toronto, Longmans, 1952. 163 pp., illus., $3.60.

This book deals with external effects of electronic devices and their utilization in electric-circuit technique. These effects are rectification, control of current, amplification, frequency multiplication and intermodulation, negative-resistance performance, and electronic-switch action. In treating these effects it is assumed that the electron-transit time is negligible in the time scale of voltage and current changes and has no influence on performance.

Mechanics of fluids. Glenn Murphy. Scranton, Pa., International Textbook Company (Laurel), second edition, 1952. 309 pp., illus., $7.20. (Canada)

In this introductory textbook on the behavior of fluids the approach and techniques are those which have proved successful in the mechanics of solids. The basic method of analysis is that of the free-body, used in conjunction with the fundamental principles of mechanics, expressed in Newton's laws of motion. Numerous practical applications of the theory are cited, and numerical and laboratory problems are provided. Important revisions are in the material on viscosity, flow-nets, jets, fluid couplings and automatic transmissions.

Proceedings of the national electronics conference. Volume VII. 1951. Chicago, The Conference, 1952. 607 pp., illus., $6.00. (Canada)

As in the previous volumes the seventy or eighty papers presented are grouped in classified sections under the following headings: servo theory and distance measurement; electron tube developments; information theory; audio systems; signal detection; high-frequency measurements; analog computers; application of magnetic amplifiers; circuit analysis; high-frequency electron tubes; industrial inspection and measurement; medical applications; industrial applications; television; magnetic amplifiers; components, measurement, and assembly; microwaves and propagation.

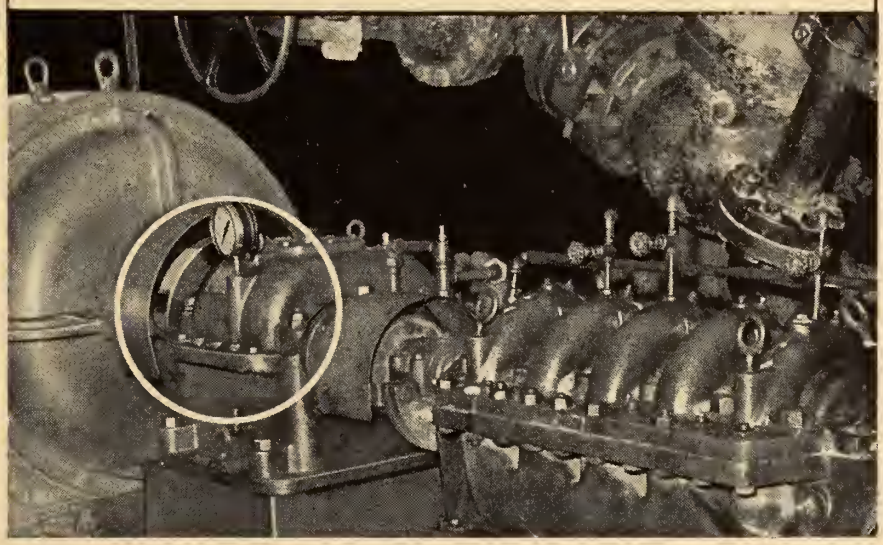
STANDARDS REVIEWED

British Standards, British standards institution, 24/28 Victoria Street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 1650, parts 2 and 3: 1952 — Capacitors for connection to power-frequency systems. Part 2: Intermittently rated capacitors. Part 3: Continuously rated industrial capacitors below 1 kV Ar. 3/–.

These parts deal with capacitors having

No jolt! No shock! No danger!



The BLM Automatic Clutch eliminates the ravages of starting shock and dangerous overloading—in any type of transmission drive—through natural, centrifugal force. Just step on the starter—or press the button—BLM does the rest. Installation shown is BLM Type SRC-50 Clutch in drive to speed reducer to centrifugal pump.

Write for catalogue showing typical installations, charts, graphs, etc.

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impregnated paper dielectric. They include details on rated capacitance, intermittent voltage, frequency, permissible overloads, discharge devices. In the sections on tests are given tests on the capacitor elements, on capacitors, loss angle and insulation resistance.

B.S. 1728, part 4: 1952 — Methods for the analysis of aluminium and aluminium alloys. Part 4: Zinc (Polarographic method). 2/–.

This is published as an alternative to the mercuric thiocyanate method already published as part 3. As with polarographic methods in general, it is particularly useful for alloys having a low zinc content and, over a range of 0.02 to 3 per cent zinc, gives results having close agreement with the mercuric thiocyanate method.

B.S. 1862: 1952 — Cables for vehicles. 2/6.

Part 1 of this standard deals with ignition cables while part 2 deals with low-voltage cables for vehicles. The only type of ignition cable covered by the present edition is that having rubber insulation. The second part is concerned with starter, lighting and general purpose and steering column cables. These cables are either rubber-insulated or P.V.C. insulated and are intended for automobile wiring systems of voltages not exceeding 100 volts.

Canadian standards. Canadian standards association, National research building, Ottawa, Canada.

C.S.A. C22.2 No. 44: 1949 — Flexible tubing (Non-metallic). $0.50.

This specification applies to flexible tubing (non-metallic) for the mechanical protection of insulated wires on circuits of 300 volts or less. It covers materials, assembly, construction of double-wall tubing, sizes, tension, moisture absorption, flame resistance and other properties.

C.S.A. C22.2 No. 46: 1942 — Construction and test of electric air-heaters, 2nd ed. $0.50.

This specification applies to both portable and stationary air-heaters for potentials of 250 volts or less. The section on construction deals with frame and enclosure, mechanicals assembly, protection against corrosion, capacity, etc. Portable heaters are covered in details, paragraphs being devoted to stability, reflectors, guards, plugs and cords, switches, etc.

C.S.A. C22.2 No. 94: 1952 — Construction and test of special enclosures 2, 3, 4 and 5. $0.75.

This specification applies to the following types of enclosures for electrical equipment having potentials up to and including 2,500v between conductors on ungrounded systems and 4,500v between conductors. Enclosure 2 is drip-tight, while enclosure 3 is weatherproof, 4 is water-tight and 5 is dust-tight, but not suitable for class 2 hazardous locations.

C.S.A. C77: 1952—Oil circuit breakers, 2nd ed. $1.75.

The present work covers both indoor and outdoor oil circuit breakers for alternating current only, having interrupting capacities of 500,000 kva or less at rated voltage and having voltage ratings of 15,000 volts or less. The automatic oil circuit recloser is not included in this category.

C.S.A. C115: 1952 — Hardwood plywood. $0.75.

This specification provides minimum requirements for hardwood plywood panels in terms of a) four grades dealing with appearance and quality of veneers used in the fabrication of plywood, b) three types dealing with water resistance of the bond and general durability of the plywood.

BOOKS RECEIVED

Alberta trade index of made in Alberta goods and Alberta manufacturers. Alberta, Department of industries and labour. Edmonton, the department, 1951. 387 pp., illus.

Canada 1952: the official handbook of present conditions and recent progress. Canada. Dominion bureau of statistics. Ottawa, the bureau, 1952. 312 pp., illus.

McAVITY PULP STOCK VALVES

Designed to meet ALL requirements

Non-clogging and self-cleaning, these valves are positive in action at all times and under all operating conditions.

AVAILABLE IN 8 CLASSES—

Iron Body Bronze Mounted . . . Iron Body with Ni-Resist gate . . . All Ni-Resist . . . Ni-Resist with Stainless Steel Gate . . . All Stainless Steel KA2MO . . . All Acid-Resisting Bronze . . . Rubber Lined (all interior surfaces) . . . Rubber Lined with Stainless Steel Gate.

AND 10 OPERATING METHODS—

In addition, McAvity Pulp Stock Valves can be supplied for Manual, Pneumatic, Hydraulic, or Limitorque Electrical operation. Complete information from nearest branch.

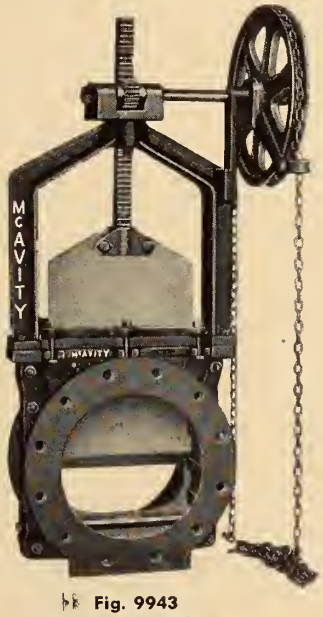

Fig. 9943 with Rack and Gear, Chain Operated

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Montreal - Toronto - Winnipeg - Vancouver

Canadian trade index 1952. Canadian manufacturers association. Toronto, the association, 1952. 1,102 pp., illus., $7.50.

Electrical engineering: theory and practice. W. H. Erickson and N. H. Bryant. New York, Wiley, c1952. 523 pp., diags., $7.50 (Canada).

The engineering and industrial catalogue, 7th ed., 1951-1952. Toronto, Canadian engineering publications, 1952 501 pp., illus.

Frost action in soils: a symposium. United States, Highway research board. Washington, the board, 1952. 385 pp., illus., $4.40 (Canada). Highway research board special report No. 2, Publication No. 213.

Handbook of engineering fundamentals, 2nd ed. O. W. Eshbach, ed. New York, Wiley, 1952. Various paging, illus., $12.50 (Canada).

Harwell: the British atomic energy research establishment 1946-1951. Great Britain, Ministry of supply and Central office of information. London, H.M.S.O., Ottawa, United Kingdom information office, 1952. 128 pp., illus., 6/-.

Management controls in industrial research organizations. R. N. Anthony. Boston, Harvard university, Graduate school of business administration, 1952. 537 pp., tables, $8.10 (Canada).

Newfoundland Who's who 1952. St. John, Newfoundland Who's who, 1952, Montreal, Guardian associates ltd., 1952. 102 pp., illus., $2.50.

Pull's workshop practice: a practical text book, 9th ed. Rev. by P. S. Houghton. London, Technical press, 1952. 739 pp., illus., 24/-.

Public speaking for business men, 3rd ed. W. G. Hoffman. Toronto, McGraw-Hill, 1949. 412 pp., $5.65.

The scientific papers of James Clerk Maxwell. 2 volumes. W. D. Niven ed. New York, Dover, 607 pp., 806 pp., illus., $12.50.

Statistical tables and formulas. A. Hald. New York, Wiley, London, Chapman, c1952. 97 pp., $3.00 (Canada)

Statistical theory with engineering applications. A. Hald. New York, Wiley, London, Chapman, c1952. 783 pp., $11.25 (Canada).

TECHNICAL BULLETINS RECEIVED

American water works association. Tentative standard specifications: No. B501-51T — Caustic soda.

American welding society. Tentative rules:

No. D3.4-52 — Welding piping in marine construction: ferritic alloy steels.

. . . Standard rules:

No. D5.1-52 — Field welding of steel storage tanks.

Association of short-circuit testing authorities. Publications:

No. 10 — Comparison between British and American standards for the short-circuit rating, performance, selection and testing of oil circuit-breakers.

Bell telephone system. Technical publications. Monographs:

No. 1925 — Universal equalizer chart, by D. A. Alsberg. No. 1927 — Effect of packaging on corrosion of zinc plated equipment, by K. G. Compton and others. No. 1928 — Observer reaction to video cross talk, by A. D. Fowler. No. 1929 — the mechanism of electrolytic rectification, by H. E. Haring. No. 1930 — Heat contents and dissociation pressures of SrO, BaO, CaO, $BaCO_3$ and $SrCO_3$, by J. J. Lander. No. 1931 — Acceptance inspection of purchased material, by J. E. Palmer and E. G. D. Paterson. No. 1932 — Transistor circuit design, by Gordon Raisbeck. No. 1933 — Polyethylene for wire and cable, by V. T. Wallder. No. 1934 — Germanium crystals; motions of carriers; and p-n junctions, by E. Buehler and others. No. 1935 — Electron beam convergence by a magnetic field, by M. E. Hines. No. 1936 — Crystal structures and chemistry of Ba-Ni-O compounds, by J. J. Lander and L. A. Wooten.

British electrical and allied industries research association. Technical reports:

No. A/T124 — An investigation to develop methods of test for impregnating varnish, by H. R. Heap. No. C/T106 — The design and development of three new types of gust anemometer, by H. H. Rosenbrock. No. G/T246 — Calculated curves of inductive energy at the start of arcing in fuses, by H. W. Baxter. No. L/T226 — The dielectric properties of certain benzene derivatives in the solid state, by A. Turney. No. L/T258 — Field dependance of the dielectric constant, by J. J. O'Dwyer. No. L/T261 — Transcription of electrodynamic relations into different systems, by H. Pelzer. No. N/T61 — Stainless steel magnetic recording wire, by W. Sucksmith. No. N/T62 — X-ray studies of metal structures: a summary of recent work in the crystallographic laboratory, Cambridge, by W. H. Taylor. No. Q/T113 — The measurement of axial magnetic forces in transformer windings, by M. Waters. No. Q/T115 — The calculation of transformer thermal data from readings taken in service, by M. R. Dickson. No. Q/T116 — Generation of gases in transformers. Resume of available information, by M. R. Dickson. No. Q/T117 — Temperature gradients in transformer windings and rates of oil flow in transformer tanks. A critical review of published information, by B. L. Coleman. No. Q/T118 — The operation of naturally cooled outdoor transformers as affected by weather and surroundings. Preliminary review, by M. R. Dickson. No. Z/T82 — The A. C. Argonarc process for welding aluminium: an oscillographic analysis of effects of welding transformer open-circuit voltage on arc re-ignition, by L. H. Orton and J. C. Needham.

Canada. Department of mines and technical surveys. Mines branch. Memoranda:

No. 120 — Preliminary report on coated lightweight concrete aggregate from Canadian clays and shales. Part 2: Manitoba and Saskatchewan, by J. G. Matthews.

Canada. National research council. Canadian government specifications board. Specifications:

No. 14-GP-1a — Thermometers; clinical. No. 18-GP-2 — Coke; domestic. No. 18-GP-3 — Briquettes. No. 25-GP-7 — Dressing; liquid web equipment. No. 25-GP-10 — Polish; furniture, liquid. No. 25-GP-14 — Compound; oil-and-water-absorbing. No. 25-GP-11 — Cleaner and polish; automobile, liquid. No. 32-GP-235a — Jelly powder.

Illinois university. Engineering experiment station. Bulletin. Bulletin series:

No. 398 — A critical review of the criteria for notch-sensitivity in fatigue of metals, by C. S. Yen and T. J. Dolan. No. 399 — A study of combined bending and axial load in reinforced concrete members, by Eivind Hognestad.

. . . Circular series:

No. 63 — An economic study of fuels in manufacturing, by Walter H. Voskuil. No. 64 — What do we know about diagonal tension and web reinforcement in concrete? A historical study, by Eivind Hognestad.

. . . Reprint series:

No. 48 — Progress report of investigation of railroad rails, joint bars, and rail webs, by R. E. Cramer and R. S. Jensen.

Louisiana. Department of highways. Biennial reports: statistical and technical supplements:

Fifteenth biennial report, 1948-1949. Sixteenth biennial report, 1950-1951.

Minnesota university. Institute of technology. Engineering experiment station. Bulletins:

No. 34 — Principles affecting insulated built-up roofs, by C. E. Lund and R. M. Granum.

United States. Department of commerce. National bureau of standards. Building materials and structures report:

No. 130 — Methods and equipment for testing printed-enamel felt-base floor covering. No. 131 — Fire tests of gunite slabs and partitions. No. 132 — Capacities of plumbing stacks in buildings.

. . . Circulars:

No. 520 — Mechanical properties of metals at low temperatures.

. . . Handbooks:

No. 50 — X-ray protection design.

United States. Highway research board. Bulletins:

No. 45 — Subsurface drainage. No. 48 — Off-street parking; legislative trends, administrative agencies.

PAMPHLETS RECEIVED

Cabot reinforcing carbon blacks for rubber. Godfrey L. Cabot. Boston, the company, 1952.

The corrosion resistance of tin and tin alloys. S. C. Britton. Greenford, Middlesex, tin research institute, 1952.

Power transmission directory and trade names index, 9th ed., 1952-1954. London, Trade and technical press, 1952.

Rental rates on contractors' equipment 1952. Canadian construction association. Ottawa, the association, 1952.

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

Appointments and Transfers

Hundred Years of Service.—A century of continuous service to Canadian homes, farms and industry is being celebrated this year by the Montreal Division of Westeel Products Limited. The Montreal division, under its original name of Geo. W. Reed & Co. first opened its doors for business in 1852. This was the year of Montreal's "Great Fire", a fire which destroyed a major portion of the city. Had it not been for this fire, Company officials say, and the alert business sense of a young man named George Washington Reed, this historic Canadian company would never have been formed. Reed, an experienced roofer living in Boston, heard of the disaster, visualized the tremendous number of homes and buildings that would need new roofs, and promptly headed north for fire-swept Montreal to set himself up in the roofing business. Evidence of the quality of Geo. W. Reed & Company's early work may be seen today in the still intact slate roof the company laid in 1854 on Montreal's famed Christ Church Cathedral. This, it is claimed, is the first building in Canada to be constructed with an entire roof of slate. In 1930, Geo. W. Reed & Co. joined with Westeel Products Ltd.

•

Steel Scrap.—Steel's two chief ingredients, pig iron and scrap steel, continue to be matters of national concern. Canada's increasing need for steel and the Canadian steel producer's huge expansion program to meet that need, make the nation's supply of raw materials for steelmaking a topic of special interest. Currently, ferrous scrap is still in good supply in both Canada and the U.S. However, the long-term outlook is for increased scrap consumption in both countries.

To provide a convenient news source on scrap, the Canadian Scrap Iron & Steel Committee is issuing this Bulle-Service. To obtain copies of the Bulletin, write to Canadian Scrap Iron & Steel Committee, 33 Scott St., Toronto 1, Ont.

•

New C.G.E. Office.—A new office and warehouse building is being erected in London by Canadian General Electric Company. Of modern design throughout the building will have over 49,000 sq. ft. of floor space. It will serve as a distributing centre for electrical equipment of all types in the industrial and commercial markets of London, Sarnia, St. Thomas, Woodstock, Stratford and Goderich. Contracts for the construction are being released and completion is planned for early in 1953.

•

C.M. & S. Expansion.—Mining operations at the Tulsequah, B.C., property of The Consolidated Mining and Smelting Company will be expanded to a 500-ton daily rate by next January. At the present time, a $500,000 program is in progress to increase the capacity of the concentrator, which is currently handling ore from the Company's nearby Big Bull and Tulsequah Chief mines at a 300-ton daily rate.

•

C.G.E. Staff Alterations. — As part of a broad-scale decentralization of the operations of Canadian General Electric Company, J. S. Keenan, general manager of the Industrial Products Division, has recently announced the departmental structure of his Division which has been sub-divided into five product departments and five centralized departments.

The managers of the five product departments are D. B. Thomas (Air Conditioning Department), A. E. Byren (Chemical Department), W. D. Scholfield (Electronic Equipment Department), W. F. Smith (Industries Department) and W. H. Prevey (Construction Materials Department).

Managers of the centralized departments of the Division are V. R. Young (Advertising and Sales Promotion), J. A. I. Kidd (Application Engineering), G. A. Sproul (Facilities Planning), R. K. Carty (Finance) and O. A. Peterson (Relations).

•

Burndy Executives.—F. H. McLenaghan has been named general manager and S. G. (Garton) Ward is now sales manager of Burndy Canada Ltd.

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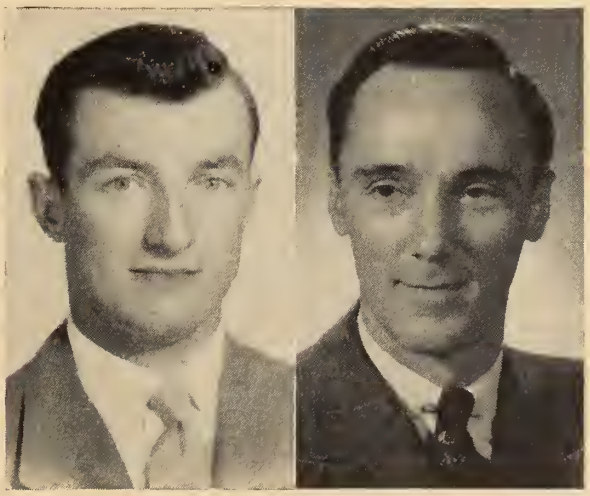


F. H. McLenaghan S. G. (Garton) Ward

R. H. Warner

D. K. Brundage

Jenkins Brothers Appointments. — Herbert H. Gee, vice-president in charge of sales, Jenkins Bros. Ltd., has announced the appointment of Delmar K. Brundage as sales manager of the company. Mr. Brundage is moving to the Company's head office in Montreal from Toronto, where he has been in charge of Ontario sales since January 1943. Mr. Brundage is being succeeded at Toronto by Rothwell H. Warner, who has been a salesman in the Ontario territory since 1944.

●

Gould Batteries. — Gould Storage Battery Limited has changed its name to Gould-National Batteries of Canada, Ltd. The head office of the company is at Kingston, Ont., and factories are located at Fort Erie, Kingston and Calgary. The head sales office is at 185 Eileen Avenue, Toronto 9, Ont.

●

Defence Production Changes. — The following changes have been made in the Department of Defence Production: W. R. McLachlan is now director of the electronics division. He is on loan from the John Inglis Company Ltd. of Toronto. He replaces G. M. Grant, who has been appointed as co-ordinator of the production branch of the Department.

●

Dow Chemical Appointments. — Dow Chemical of Canada Limited, has announced the following new appointments in its sales organization. Gordon W. Beatty is now manager of the plastics sales division. He succeeds Ralph M. Munro, who was formerly in charge of both the Plastics and Coatings and Solvents Sales Division. Mr. Munro will now devote his full time to the Coatings and Solvents Division.

J. Douglas Martin has been named as sales engineer for the Company's Toronto Branch Office. He will assume responsibility for the numerous customer contacts previously handled by Mr. Beatty. Jack A. Thomas has been named resident sales engineer for British Columbia. He will reside in Vancouver.

George L. A. Pinck has succeeded Mr. Thomas as a sales engineer for the Montreal Branch office.

●

James D. Lowry. — James D. Lowry has been appointed manager of Canadian Johns-Manville's Toronto plant. He succeeds T. H. Eaton who has been named manager of Johns-Manville plant at Marrero, Louisiana.

●

R. A. Mitchell. — R. A. Mitchell is now Director of the Mechanical Transport Division in the Department of Defence Production. He is on loan from the International Harvester Company of Canada Limited.

●

Dunlop Appointments. — J. I. Simpson, president of Dunlop Tire and Rubber Goods Company, Limited, Canada has announced that D. B. Collett, vice-president and general manager has been appointed an executive director of the Dunlop Rubber Company, Limited, England and will leave for the United Kingdom the latter part of this year. Mr. Collett will continue as a member of the board of directors of the Canadian Company.

J. P. Anderson, C.B.E., chief purchasing agent of the Company in England has been appointed vice-president and general manager to succeed Mr. Collett. He took up his new duties early this month.

●

Name Change. — The Roofers Supply Co. Ltd. has changed its name to "Rosco Metal and Roofing Products Ltd."

The Company has been engaged in the roofing and sheet metal warehousing and manufacturing business since 1899. In announcing the change Harvey Pipher, president of the Company stated "The name 'The Roofers Supply Co. Limited' which is so well known, no longer embraces the present operation of the Company. That, while many of our customers know our complete line, there are some with whom we would like to do business, who when seeing the old name might think of us only as suppliers of roofing materials. Our business has simply outgrown its original name."

The Company was incorporated 53 years ago and the original office and warehouse was located on the Esplanade in Toronto. The founders of the Company were a group of contractors, all of whom were dependent upon the United States and Great Britain for supplies. They banded together to form an organization that could economically purchase roofing materials in larger quantities. The original association was so successful that they soon began purchasing other materials and became established in the jobbing and metal warehousing business.

The progress of the Company has been steady and offices and warehouses were opened in Montreal and Ottawa in 1925, in Quebec City in 1927 and in London, Ont. in 1935.

The name change does not affect ownership, management, policies, prices, or the high standards of "Rosco" products.

●

New Equipment and Developments

Seven Islands Report.—The Department of Mines, Province of Quebec, Parliament Buildings, Quebec City, have issued a report and a geological map covering the area north of Seven Islands, Quebec.

The railroad being built between Seven Islands and the large iron deposits of Ungava is opening up a country hitherto little explored. Foreseeing that the region would attract prospectors, the Quebec government started a program of geological investigations along the railway route and in the adjoining territory. It previously had mapped the geology of the country for a distance of 24 miles northeasterly from Seven Islands and now has extended the mapping northward to cover an additional 200 square miles in the Nipissis River area. A preliminary report on this area, has been released by the Hon. C. D. French. Copies of the report (P.R. No. 272) accompanied by a geological map may be obtained by writing to the department.

●

Steel Pre-Cleaner. — A compound designed especially for use as a pre-cleaner for steel that is to be deep drawn or extruded is announced by the Detrex Corporation, Detroit 32, Michigan.

The compound, Detrex 61, is used in a soak tank at approximately 190 degrees F. at a concentration from 6 to 10 ounces per gallon. It completely removes oil, grease and dirt from all ferrous parts. Complete information may be obtained by writing to the Company.

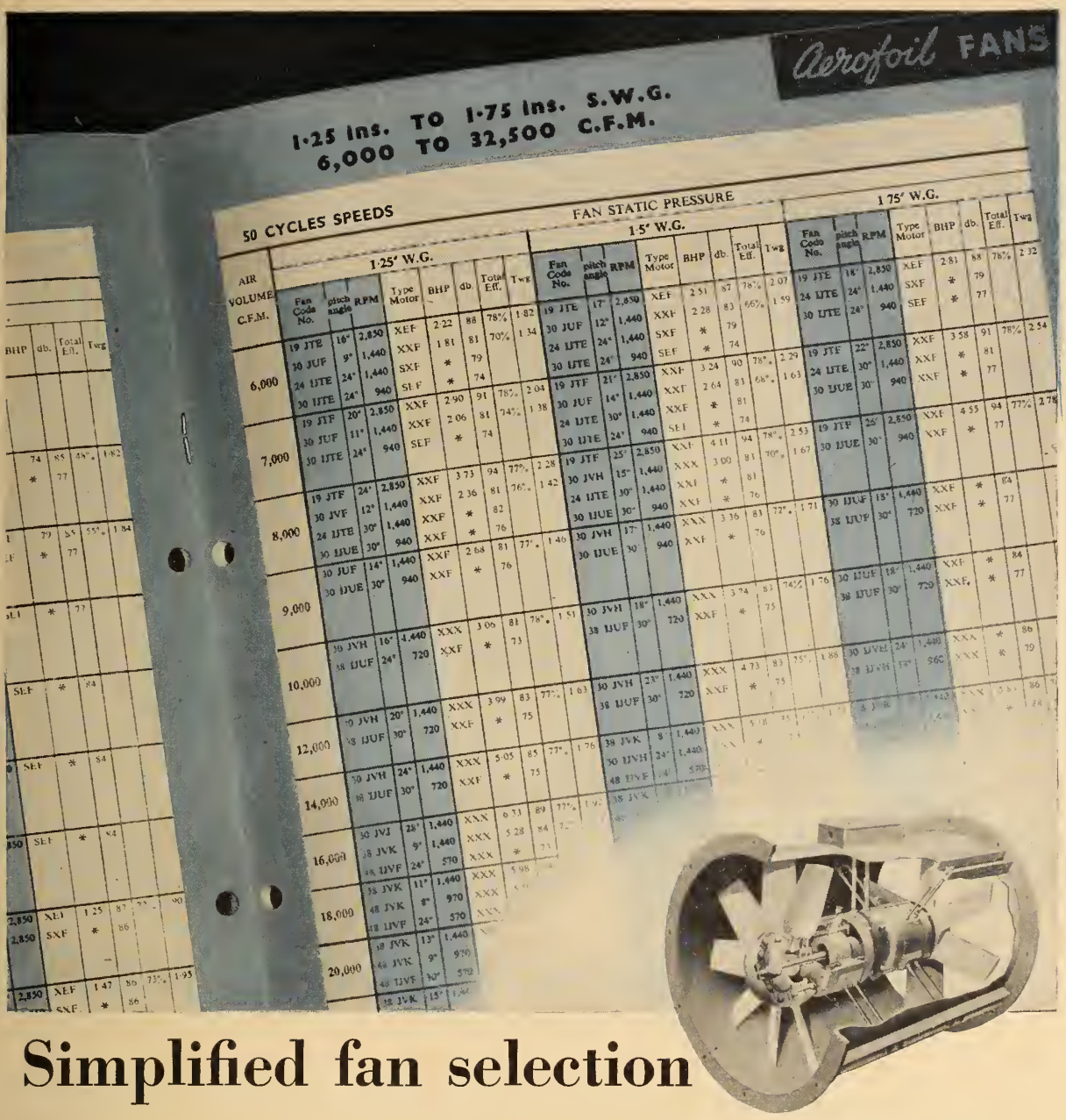
●

Water Treatment. — A new process equipment for softening and dealkalizing water and increasing the capacity of anion exchange resins by 50 per cent has recently been announced by American Water Softener Co., 330 W. Lehigh Ave., Phila., Pa.

Complete information may be obtained by writing to the Company.

●

Safety Switch. — A new mercury switch for use in hazardous, explosive locations has been developed by the Tigerman Engineering Company, 4332 North Western Ave., Chicago 26, Ill. A hermetically sealed mercury switch, mounted on a lever-operated armature is the operating heart of the unit. The switch is set in operation by a selector knob or push-button which inclines the armature, thereby actuating the mercury switch. Any possibility of a spark is eliminated because of the all-



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What fan will be best for that duty? What size and speed will be cheapest, quietest or most efficient? A quick answer is provided by the multi-rating tables in the Aerofoil publication V.1089C. A selection of different fans per duty is listed against numerous volumes and pressures ranging from 160 to 35,000 c.f.m. and 0.1″ to 7″ w.g. Each entry states size, speed, b.h.p., decibel rating total efficiency and total pressure.

This booklet includes detailed information about the G.E.C. line of Aerofoil Single Stage as well as Dual Duty Fans. For your free copy please address your request to The British General Electric Co. (Canadian) Ltd., 1510 Drummond St., Montreal.

Aerofoil **FANS**

Complete range of fans

In addition to the Single Stage and Dual Duty Aerofoils, a complete range of propeller fan equipment for industrial and commercial application is available. All fans are made by Woods of Colchester Ltd., England—an associated company of The General Electric Co. Ltd., of England.

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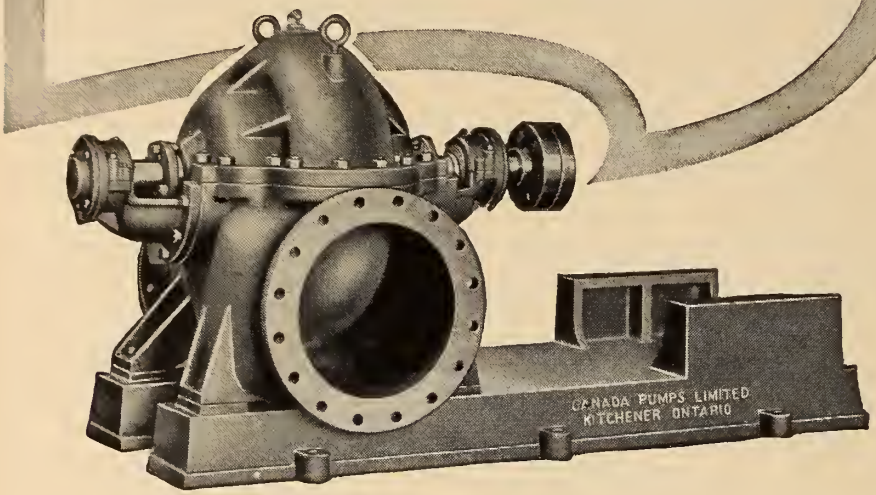
THE BRITISH GENERAL ELECTRIC CO. (Canadian) LTD.

1510 Drummond St. • Montreal **137 Wellington St. W. • Toronto**

Agents in British Columbia and Alberta:—Electric Power Equipment Ltd., Vancouver, B. C., and Edmonton, Alta.

Engineered with ALL your costs in mind...that's why it saves you MORE!



THE "Canadian Buffalo" DOUBLE SUCTION CLEAR WATER PUMP

The initial cost of this pump is repaid over and over again by savings from its lower maintenance costs *plus* fewer costly process interruptions for pump repairs. Add to these important savings the longer service life of this pump and you have the answer as to why it represents your greatest value in pumps. Check these outstanding special features:

★ *Horizontally Split Casing*, permitting inspection of the interior of the pump without disturbing the pipe connections.

★ Specially designed double suction, hydraulically balanced impellers.

★ Deep, easily serviced, stuffing boxes.

★ High grade, all machined steel shaft, covered by protecting bronze sleeve.

★ Heavy duty grease lubricated ball bearings located in rugged housings.

★ Extra substantial cast iron ribbed subbase with drip lip and sloped drain.

The "Canadian Buffalo" Double Suction Clear Water Pump is fully described in our free bulletin No. 955. Write for your copy today.

"Canadian Buffalo"

CANADA PUMPS LIMITED

HEAD OFFICE: KITCHENER, ONTARIO

Air Handling Problems?

Our associate organization, the Canadian Blower & Forge Company Limited maintains a staff of specially trained representatives to help you solve your air handling problems. Branch offices in principal cities of Canada.

ENGINEERING SALES OFFICES

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mechanical nature of the actuating linkage. Write to the Company for detailed information.

●

Hamilton Gear Price Reductions. — The Hamilton Gear and Machine Co. Ltd., 950 Dupont St., Toronto 4, have announced that substantial price reductions have been made on all their small worm gear speed reducers of the side plate type, sizes 22 to 51, with 2 to 5 inch centre distance, listed in catalogue No. 106.

The Company states "We have recently improved our manufacturing techniques by better jigs, fixtures and other tooling. This, coupled with increased volume of sales has enabled us to manufacture in much larger and more economical quantities. Consequently costs have been reduced and we are passing these savings on to our customers in the form of substantial price reductions.

The Company also states that reduced prices are also in view for the medium size worm units of 6″ centres and larger.

●

Oil Pipe Line Clamp. — A new pipe clamp for coupling loading and discharge lines to the pumping system of oil tankers has been successfully tested and will shortly be adopted as standard equipment on many Shell tankers.

The clamp was devised by John Lamb, O.B.E., chief of the Shell's Marine Development and Research Department in the United Kingdom. The new clamp enables the blank flange to be removed and the flexible shore line to be connected to the loading and discharge lines aboard the tanker in about 2½ minutes, as against 30 to 60 minutes for the connections at present used. The simplicity of operation also makes for greater speed in handling.

The new clamp consists of two parts, one section comprising a hinged adjustable collar immediately behind the flange on the flexible shore line. The other portion consists of a short length of mild steel piping permanently bolted to the end of the intake or discharge line on the tanker. On this pipe are four hinged arms, easily operated by hand. These hold the shore-to-ship lines in position and replace the present system of bolts and nuts and bolted clamps. As an added safety precaution and to ensure a perfect connection, two guide arms 120° apart project from the underside of the fitting and once the short pipe is resting on these arms it is virtually impossible to make a faulty connection.

It is possible that the new equipment will have considerable usage in the oil industry, including, for example, the coupling of lines for the filling of aircraft.

●

New Honeywell Switches. — Newly designed Honeywell mercury switches, embedded in plastic "potting" compounds for added protection, are announced by Micro Switch Division of Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Ont.

The first of these new mercury switch assemblies is the IMPI switch, whose overall size is 2½ inches long, ¾ inch wide, and 1⅛ inch high. This unit provided less than 1 degree differential angle, with an electrical rating of 2 amperes 115 volts a-c; or 1 ampere 115 volts d-c.

●

Time Losses. — More than 51 percent of the total time lost and 56 percent of the total numbers of workers involved in work stoppages in Canada arising from industrial disputes during June, 1952, was accounted for by the strike of loggers, lumber and wood products factory workers in

WESTEEL OFFICE PARTITIONS

Partitions to Serve for the Life of the Building

"But, man, we have to move partitions with every change of tenants."

"That's all right—you can move Westeel Partitions as often as you like—they will always look as though they grew where they are."

That is only one advantage you get in modern Westeel Office Partitions. Others are:—Handsome appearance, great stability and easy access for electric wiring.

Door sections are interchangeable with stationary sections. Wickets or grills may be installed anywhere. Receptionists' cubicles can be furnished.

All steel, or steel and glass, colours to choice, any desired arrangement, three styles to choose from. Privacy, dignity, fire resistance, sound insulation, good appearance, easy movability—all these are built right into Westeel Office Partitions and endure for the life of the building.

Write our nearest office. Ask for Catalogue No. 34.

WESTEEL PRODUCTS LIMITED

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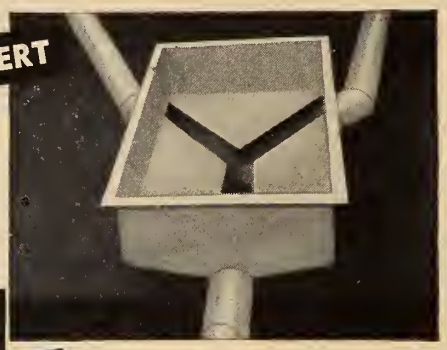
Also Sales Offices in HALIFAX, QUEBEC, OTTAWA

Polythene PLASTIC

• high resistance to moisture, acids and alkalis • chemically inert • fatigue resistant • flexibility

CHEMICALLY INERT



Polythene is used for chemical drains because its outstanding properties make it the most economical and practical of all materials.

FLEXIBLE

Polythene makes possible the "squeeze" bottles used for deodorants and a variety of other liquids. It retains flexibility even at sub-zero temperatures.

DIELECTRIC

The extraordinary chemical, electrical and physical properties of Polythene have made it almost indispensable as the dielectric in radio frequency cables.

WRITE US, on your Company letterhead, for your copies of the informative, helpful publications on Polythene plastic.

We also have complete information on many other plastics — let us know those in which you are interested and we'll send you copies of our publications dealing with them.

• Our Technical Service is available to all users and prospective users of C-I-L plastics. Remember, C-I-L is the first place to check when you have a plastics problem. Sales offices are located coast to coast.

C-I-L Plastics
SERVING CANADIANS THROUGH CHEMISTRY

PLASTICS SECTION
Chemicals Department
CANADIAN INDUSTRIES LIMITED

the coastal regions of British Columbia. This stoppage involved 33,500 workers and accounted for a time loss of 365,000 man-working days.

•

Tachometer Kits. — New tachometer kits, containing all the components necessary to provide instantaneous and permanent records of machine performance at a central location, are available from Canadian General Electric Company's Meter and Instrument Section.

Four kits are available in the new line. A typical installation would include a d-c tachometer generator, a tachometer indicator, a switchboard-type tachometer recorder, and (where a continuous web of material is produced) a web-break detector. Audible or visual alarm systems are optional accessories. For complete information write to the Meter and Instrument Section at any C.G.E. office.

•

Maur Products. — Maur Products of Canada Limited, a subsidiary of a Norwegian firm have opened a factory in Peterborough, Ont. The parent plant is located in Oslo, Norway. They manufacture hand trucks, trailers, and wheel axle equipment.

The Company features a patented wheel design incorporating ball bearings and which, with pneumatic or solid tires, afford exceptional rolling ease.

•

Argon Flow. — A new, direct-reading combination regulator and flowmeter for the measurement of argon flow is announced by Dominion Oxygen Company, Limited. The regulator-flowmeter is designated as R-502. It is designed for use with Heliarc welding, Argon Metal Arc welding and other related processes.

The regulator-flowmeter has a new three-stage type regulator maintaining constant inlet pressure and accurate flow. Factory presetting of the second stage of the regulator delivers argon at a constant pressure of 20 lb. per sq. inch. The flowmeter, with a finger-tip control adjusting valve, permits accurate, steady flow rates up to 60 cu. ft. per hour. The Company will be pleased to send any additional information. Write to the Dominion Oxygen Co. Ltd., 40 St. Clair Ave., East, Toronto, Ont.

•

Tapping and Drilling.—The Ettco Tool Co. Inc., 594 Johnson Ave., Brooklyn 37, N.Y., announces the development of a new electric-air controlled tapping and drilling machine. Designed for use with either multiple or single spindle drilling and tapping heads and with provision for interchangeable work holders, the machine, it is claimed, can handle a wide range of drilling and tapping requirements at high production rates.

A feature of the machine is a patented electrically controlled four-way air valve with a built-in up and down speed control, developed especially for this machine. A built-in oil pump offers sufficient oil supply at all times.

The machine is designated as No. 74. It can be run on a continuous automatic cycle or single stroke operation controlled by foot or hand. Indexing fixtures or work holders, as well as multiple heads can be designed and built by Ettco to handle a large variety of parts.

Single spindle tapping attachments that take taps up to ¾" are supplied from stock. For full information write to the Company.

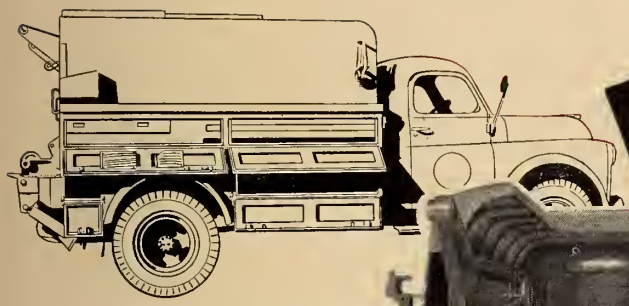
•

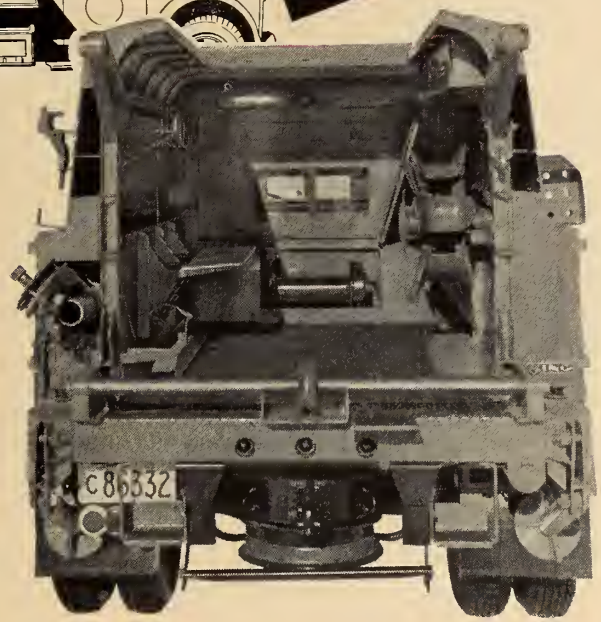
(Continued on page 1010)

count the added advantages of

KING

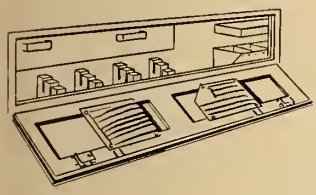
LINE CONSTRUCTION BODIES





ADDED SAFETY

Rear safety platform extending beyond body allows crewmen to stand upright and work at the rear of the vehicle — also aids in the loading of transformers and other heavy equipment.



ADDED PROTECTION

Only KING Line Construction Bodies offer absolutely weather-tight compartments. Moulded rubber stripping around all compartment doors is compressed by potented KING MASTER LOCKING SYSTEM. This assures absolute water-proof - dustproof protection for tools and equipment.

ADDED DURABILITY

An all-steel sliding roof is standard equipment on KING Line Construction Bodies to provide water tight durability over the years.

ADDED CONVENIENCE

The complete line of KING line servicing equipment includes many items for the personal safety and convenience of the crew such as folding seats, sliding communication windows, and etc.

Add to these features the facts . . . KING Line Construction Bodies have been accepted as standard equipment by Canada's leading users of Electrical Utility Bodies . . . KING Line Construction Bodies are now serving in almost every community in Ontario . . . KING Line Construction Bodies have been proved in the field under rigorous working conditions for over fifteen years!

COUNT THE ADVANTAGES — COMPARE THE FACTS — AND YOU'LL CHOOSE KING

Write for full information on the complete line of KING Line Construction Bodies and line servicing and maintenance equipment.

Distributors:

Mussens Canada Limited, Fredericton
Eastern Equipment Limited, Halifax
Craig Equipment Registered, Ottawa
Kane Equipment, Winnipeg
Contractors Supplies Limited, Regina
Wilkinson & McCleon Limited, Edmonton, Calgary
Ramp Body & Fender Works, Nelson, B.C.
Timberland Machines Ltd., Port Arthur

KING

A NAME THAT CARRIES WEIGHT

TRUCK ENGINEERING LIMITED

WOODSTOCK • ONTARIO • CANADA

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1006*)

Sketch Pads. — Ogilvie Press, 691 Fulton St., Brooklyn 17, N.Y. offer a special paper for engineer's sketch work. It carries cross section ruling that will not reproduce. The sheets may be used on blueprint, black and white or Ozalid reproductions. The paper is offered in several weights, to permit use with the various processes and a number of sheet sizes are available. For complete details, write to the Company.

●

Voltage Tester. — A new voltage tester having only one test lead and other new design features is announced by Holub Industries, Inc., 413 De Kalb Ave., Sycamore, Illinois. It is called the "Hi-Test" and indicates a-c or d-c voltage from 115 to 600 volts. Overall length of "Hi-Test" is 8½ inches; test lead with 4 inch plastic handle, 48 inches; weight with carrying case, 10 ounces. Tester is available with or without heavy black canvas carrying case which has belt loop for easy carrying.

●

Nylon-Rubber Conveyor Belting. — Nylon is making an impressive showing in its first tryout in another tough league of industrial uses — conveyor belts.

In March 1951, a conveyor belt made from nylon fabric and covered with rubber was placed in service conveying compound fertilizer from a small storage hopper to a bagging machine at the fertilizer plant of Canadian Industries Limited, Chatham, Ont.

At the end of March 1952, the belt was still in service. It had conveyed over 40,000 tons of fertilizer to the bagging machine — double the quantity any other fabric belt has been capable of handling at the plant.

The experimental belt was 22 feet 5 inches long, 12 inches wide. The belt moved 160 feet per minute and carried 1,500 pounds per minute.

"During the year the belt was in service, it was taken up two inches, considerably less than the normal stretch of the previous belt" said Murray Smith, plant manager. He continued "the only sign of failure was a few cracks on the bottom surface of the belt which, however, seemed to be causing no trouble."

●

New Valves. — A new line of temperature and pressure relief valves, for use on hot water tanks, and heaters, has been announced by McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill. Known as the 202 Series, these valves are actually a combination of two valves previously supplied. Complete information on this series of valves can be obtained by writing directly to the Company.

●

Stewart Warner Name Change. — Stewart-Warner Alemite Corporation of Canada Limited, Belleville, Ontario, manufacturers of radio and television sets, bassick casters, cushions and glides, and Alemite lubrication equipment for the farm, industrial and automotive fields, recently announced that the firm name will now be known as Stewart-Warner Corporation of Canada Limited.

●

Trane Address Change. — The Toronto Sales Office of Trane Co. of Canada Ltd., recently moved to new premises at 767 Yonge Street. These offices provide additional accommodation to serve the expanding needs of Trane business. All phases of Trane sales for Toronto and the surrounding area related to heating, cooling, air conditioning and air handling equipment are handled through this Trane office.

●

Asbestos Ore Properties. — Plans have been approved to develop the asbestos ore properties of Rhodesian Asbestos Limited, it was announced recently by Karl V. Lindell, vice-president of Canadian Johns-Manville and general manager of the Asbestos Fibre Division.

The asbestos properties are located at Mashaba in the Victoria district of Southern Rhodesia, about 200 miles south of Salisbury and about 120 miles east of Bulawayo.

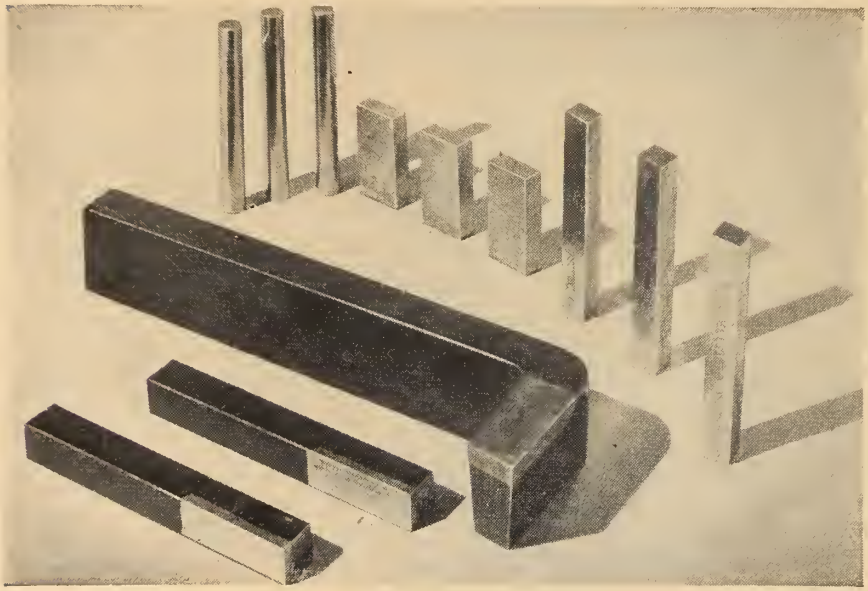
The project ties in with the Company's long-range program to maintain adequate supplies of asbestos ore for many years. Present plans call for developing the properties and the construction of a small central mill to process the asbestos bearing ore extracted from the mines.

James Robert Ewing, a Canadian, formerly of Southern Minerals & Marketing Corporation of Southern Rhodesia, has been appointed mine manager of Rhodesian Asbestos Ltd.

●

Westinghouse Transformers. — Canadian Westinghouse Co. Ltd. have introduced a completely enclosed non-ventilated dry type transformer.

It is a radical departure from the oil insulated transformer.



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Because they do not burn even when Red Hot, *Deloro Stellite 100 tools* permit heavier feeds—deeper cuts. This reduces machining time, in many instances doubling and tripling production. Write for your price list on grade 100 tips and tipped tools today.

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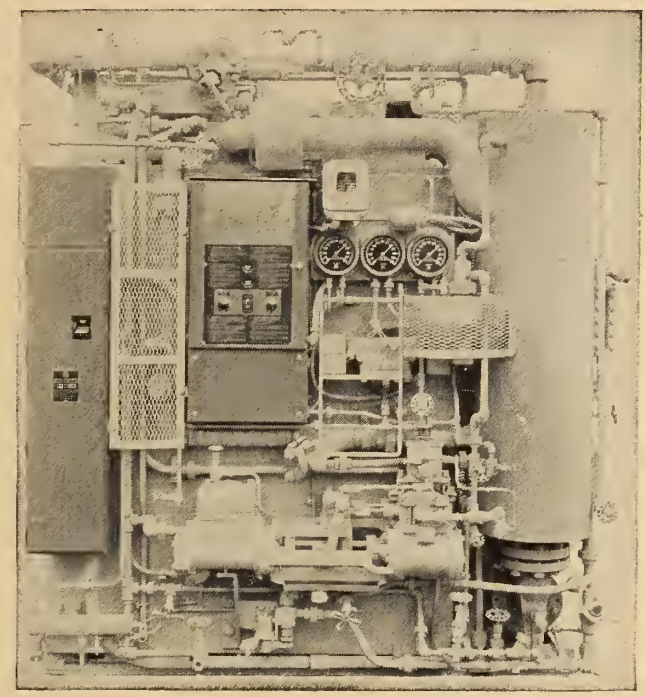
NEW · COMPACT · AUTOMATIC



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Controlled Re-circulation Steam Generator

The Elesco Controlled Re-circulation Steam Generators are adaptable to burning diesel fuel oil, Bunker C oil, or gas. Broad experience is embodied in the design to provide for lengthy gas flow through unrestricted passages resulting in the highest and most efficient heat transfer per square foot of heating surface.

Ultra-conservatism is embodied in all our claims—steam generating capacity, fuel consumption, heat release, combustion efficiency, reliability and continuous operation.

Elesco generators are particularly fitted for use in any industry where small, compact, efficient and automatic steam generators are required.

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Write for Bulletin 10,901-1 today!

THE SUPERHEATER COMPANY, LIMITED

540 DOMINION SQUARE BLDG., MONTREAL

Works: Sherbrooke, Que.

CANADIAN WOOD PIPE & TANKS
LIMITED
550 PACIFIC STREET VANCOUVER, B. C.

Called "Westinghouse Type E," the new transformers are less than half the size of the dry type they will replace. Ratings are from 3 to 50 Kva, 600 volts and below. Applications particularly notable will be in pulp, mining and smelting, textile, rubber and flour mills, or anywhere completely enclosed transformers are necessary. The "Type E" is also suitable for outdoor application. The Company will be pleased to send complete information upon receipt of enquiries.

•

X-Ray Service. — A powerful industrial X-Ray equipment at Canadian General Electric Company's Davenport (Toronto) Works, is now available to other organizations that require X-Ray film proof of quality — especially aircraft castings. This service has been approved by the R.C.A.F. with approval number T 103-3/52.

The 250 kv, X-Ray machine has a capacity of more than 2000 castings a week in excess of the needs of the company and castings up to 2000 pounds can be safely and accurately checked. Records will be provided in the form of 14 in. by 17 in. negatives complete with expert interpretation.

Address enquiries on this service to Canadian General Electric Co. Ltd. Works Laboratory Supervisor, 940 Lansdowne Ave., Toronto, Ont.

•

Asphalt-Rubber Paving. — Stabilities of various asphalt paving mixtures containing rubber are determined in the laboratory of the Natural Rubber Bureau, Washington, D.C., by means of a 60,000-lb. testing machine built by Baldwin-Lima-Hamilton Corporation, Philadelphia. This machine enables loading a Vheem Stabilometer at a closely controlled rate of deflection of specimens. Load is applied by the testing machine crosshead moving at the rate of only 0.05 inch per minute until a maximum load, usually 12,000 lb. is reached. Deflection readings on the stabilometer dial are noted at loads of 500 lb., 1000 lb., and each additional 1000 lb. up to maximum load. If desired, pressures on the paving material can be as high as 5000 lb. per sq. in.

•

New Sylvania Plant. — Sylvania Electric (Canada) Limited are building a new factory at Drummondville, Que. This marks the first construction project for Sylvania outside the United States, where the Company has plants and laboratories in 35 communities.

The new $1,000,000 undertaking will produce electronic equipment for Canada's armed services. The building will occupy 38,000 sq. ft. of floor space. The manager of the plant will be W. B. O'Keefe. Completion of the building is scheduled for the end of the year.

•

New Mine Hose. — The Industrial Products Division of the B. F. Goodrich Rubber Company of Canada Ltd., recently announced the development of Mine-Econ Hose, a completely new team of air-water mine-hose — specifically developed to meet every requirement of hard rock drilling.

The new hose is available in continuous 500 foot lengths.

The water hose is designed to operate at 200 p.s.i. and the air hose at 145 p.s.i. with burst pressures of 1000 p.s.i. and 725 p.s.i. respectively.

Two sizes — ¾ in. and 1 in are being produced in Mine-Econ air hose and a ½ in. size in water hose. For complete information write to the Industrial Products

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You're sure of satisfaction with Dominion coal. Each shipment is of uniformly high quality. In addition, Dominion's combustion engineers are always available for consultation on your problem. Assure getting maximum efficiency from your steam equipment by specifying Dominion Coal.

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DOSCO

A Division of

DOMINION STEEL AND COAL CORPORATION LIMITED

Division of the Company at Kitchener, Ont.

●

New Calcium Carbide Furnace. — The continent's most modern calcium carbide furnace went into operation August 20th in the North American Cyanamid Limited plant at Niagara Falls, Ont. Robert H. Saunders, Q.C., chairman of the Hydro-Electric Power Commission of Ontario, threw the switch to officially start the electric furnace, which is believed to have the world's largest transformer. It weighs 106 tons.

In the new furnace, the giant transformer replaces the three separate transformers used in older-type units. It transforms all three phases of electricity coming into the furnace's three electrodes.

Oblong in shape, the electrodes are of the most modern type used in industry. They are self-baking, a property that does away with periodic, costly furnace shutdowns. In the new furnaces, the electrodes are automatically built up again by a mixture of coal and pitch which is fed into the furnace to replace the consumed parts of the electrodes. The mixture is gradually raised to baking temperature in the replacement process.

Incoming voltage to the transformer is 12,000. The unit can operate on either 25 or 60-cycle power.

●

New Inglis Plant. — A new manufacturing unit is shortly to be opened in Scarborough Township, Ontario, by the John Inglis Co. Ltd. The plant is designed for extension of the manufacturing program of naval steam turbines to the design of the English Electric Company. It is one of the larger projects in the current Scarborough industrial development and is situated on a 40 acre tract of land fronting on Eglinton Avenue at the westerly township limits. The first manufacturing unit and auxiliary buildings were commenced in the summer of 1951.

The new plant has a manufacturing floor area of approximately 150,000 sq. ft. A separate steam plant will take care of heating and provide high pressure superheat steam for test purposes. It is anticipated that the initial unit will employ about 800 men.

The Company's present engineering and manufacturing plants at Toronto and those of its associate The English Electric Company of Canada Limited of St. Catharines, will continue to engage in the preparedness program and in the production and further development of their regular lines of products for industry and consumer.

●

New Centrifugal Pump. — A new centrifugal pump which operates with equal efficiency when rotated in either direction has just been announced by Gardner-Denver Company, Quincy, Ill. Known as the Gardner-Denver Model CAY, the new pump was designed primarily for circulating cooling water in air compressors, diesel and gasoline engines, and other water-cooled machines.

The new machine is suitable for heads up to 50 feet and capacities up to 67 gallons per minute. The pump is fitted with two pre-lubricated ball bearings, and has a mechanical seal that is said to eliminate stuffing box leakage. Complete details may be obtained by writing to the Company at Quincy.

●

Presses for the Plastics Industry.— A new range of presses, which will be of great interest to the Canadian plastics industry, has been announced by E.M.B. Company Ltd., Moor Street, West Bromwich, Staffordshire, England. Motive power is compressed air which can be provided by any normal supply main at between 50 and 100 lb. per square inch pressure. This means that a number of presses can be supplied from a centralized source of compressed air which enables the design to be made extremely simple and compact.

Perhaps, however, the outstanding feature of these "Airdraulic" presses is that they are designed to give an infinite variation of speed and pressure from zero up to the maximum required. The speed of operation is controlled by the self-contained hydraulic system within the machine itself. Both the speed and pressure are controlled independently of one another and can be adjusted separately. Once the stroke has been set it can be maintained and repeated virtually indefinitely without variation.

The machines are available in four sizes up to 15,680 lb. with a controlled delayed action on the three larger sizes, if required. In addition interlocked gate type guards can be supplied to protect the operator from all danger while at the same time not restricting the output of the press.

●

Increasing Shuttle Yarn Capacity.— Said to increase shuttle yarn-capacity by 50 per cent, a new textile winder produced by Muschamp Taylor Ltd., Vulcan Works, Pollard Street, Manchester 4, England, is the result of two years intensive research and is claimed to represent the greatest advance to date in the search for larger and more solid cops to give longer running time and fewer

Cusson Service Experts Test Every Job Scientifically — Nothing Left to Guesswork

Like the doctor's stethoscope, the Cusson technician's testing equipment also measures heartbeats—the throbbing pulse of mighty Diesel or gasoline engines powering the big construction and earth-moving machines.

Precision instruments, in the hands of skilled personnel, check and re-check every working part, every adjustment, to guarantee the owner trouble-free, dependable performance under any operating conditions. No matter what the job—from repairing or servicing engines and equipment to a completely remanufactured International engine—the efficient members of the Cusson "team" make sure that each unit meets Cusson's high standards of power and performance before it is allowed to leave the shop.

Scientifically designed testing equipment measures operating efficiency exactly . . . eliminating the guesswork of "adjustment by ear" . . . adding hundreds of hours to the life of expensive equipment.

Cusson's Montreal headquarters is fully equipped to handle every call for equipment repair and service. Extensive machine shops, maintenance and repair facilities are backed by the most up-to-date testing laboratories staffed by trained technicians.

Latest machines, like the massive Clayton Dynamometer, test compression, power, ignition and other vital engine functions. Hydraulic systems are "tuned" to smooth, effortless operation. Complete, modern facilities guarantee split-second accuracy in Cusson-remanufactured exchange fuel pump systems. In every department, the most advanced testing methods are used by the Cusson "engine doctors" who take a professional pride in their proficiency and craftsmanship.

Cusson service is scientific . . . Cusson service is certain.

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- Frequency conversion
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- Mining plants
- Millwrighting
- Shipbuilding

Process piping

As Canada's industrial capacity grows and becomes more complex, the demand for specialized work in the field of process piping expands. In all industries, such as paper, mining, sugar, oil refining, chemical, steam generating, sewage disposal plants and many others, piping is more and more used to move materials . . . and the fabrication and erection of piping for these new processes poses new problems. At the process piping division of the Canadian Comstock Company, many of these problems have been solved in the course of carrying out contracts for some of Canada's largest industries. New methods have been evolved in the building of cross-country steam lines and piping for heating under both high and low pressure. With its team of specialists and extensive experience, Comstock is equipped to handle *any* project involving process piping on *any* scale.

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CANADIAN COMSTOCK *Company Limited*

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HEAD OFFICE: COMSTOCK BUILDING, 206 LAIRD DRIVE N., TORONTO, ONTARIO • LONDON, ST. CATHARINES, HAMILTON, OTTAWA, TORONTO, MONTREAL, HALIFAX, VANCOUVER

weft breakages. This search has, incidentally, been intensified by the increasing use of artificial fibres such as nylon and terylene in place of the traditional coarse cotton and jute for the production of heavy fabrics.

Two models of the machine are now in production. They make cops of up to 16 and 11 inches in length with a maximum diameter of two inches in each case. In special circumstances cops of up to 20 inches can be produced.

The setting of the machine both for diameter and length of cop is claimed to be so accurate that the full internal cavity of the shuttle can be used without affecting the unwinding of the cop during weaving or damaging the yarn. This remarkable degree of accuracy has been achieved by the use of a steel builder cone, the angle of which is infinitely variable and is adjusted to suit both the required diameter and the type of yarn processed.

Spindle drive and mounting are of entirely new design. The spindle and its drive are in one piece, the spindle going directly through the gear box to the rear of the machine where the drive is by means of a belt from the main shaft. When the spindle is stopped the driving belt leaves the spindle pulley and moves on to an independent free running carrier pulley. This leaves the spindle completely free to rotate and simplifies the task of the piecing of broken ends.

The machine can be efficiently worked by an unskilled operator after only five minutes tuition. Tests have shown it to be capable of very high production both per spindle and per operative.

•

Spherical Lap Generating Machine.—A Rugby, England, firm manufacturing scientific instruments for the optical trade, is now marketing a spherical lap generating machine (eight of its machines are now operating in North America) which gives a higher precision and faster production than the usual method of radius turning. These machines, which produce lenses more accurately and much faster than any German unit as yet in production, can be used by operators who are not trained engineers.

The clock setting of this machine ensures precision setting to 30 seconds of the arc by the use of accurately marked worm and pinion coupled to the cutter spindle head. Strong or weak curves to suit all surfaces are provided for by a micro-movement of the cross slide. The machine was designed to cover laps up to seven inches but users are generating laps up to nine inches and curves are generated to an accuracy of .0002 inches.

This firm—Tecnaphot Ltd., East Union Street, Rugby—also manufactures single and multi-spindle machines capable of dealing with lenses of the smallest diameter up to seven inches diameter and with curvatures from plane to curve of less than 0.25 inches radius. There is also a machine which deals with cylindrical prescriptive work covering a wide range of dioptic curvatures and a wide range of high temperature mercury thermometers, industrial thermometers and glass "bubbles" for woodworkers' levels.

•

Giant Welding Manipulator.—What is believed to be the largest welding manipulator ever built in Britain has been completed by the Leek, England, engineering firm of F. Bode and Sons. It will handle 168,000 lbs. and components up to 40 feet long. Weighing 82,880 lbs. it is 14 feet long, 14½ feet wide and 11 feet 8 inches high.

The firm, which sends machines to all parts of the world, designed and made its first manipulator in 1942. It has since completed many others, ranging from 560 lbs. upwards.

The manipulator cuts out the necessity to use a crane, except for placing the job on the manipulator and removing it on completion. It enables the welder, using a rotating table which also tilts through a wide arc, to be independent of any other assistance. Time saving, it is claimed, is up to 30 per cent.

•

Die Finishing Machines.—To eliminate the hand chipping and grinding with mounted emery points ordinarily necessary for finished tool steel dies, the Atlas Diesel Company, Beresford Street, Wembley, Middlesex, England, has produced a series of pneumatic rotary filing machines for use in conjunction with tungsten carbide cutters.

It comprises a range of light but powerful tools driven by compressed air through a soft quarter-inch flexible hose with a choice of speeds between 650 and 50,000 revolutions per minute. The bodies of the tools are made of polished aluminium, and the weights vary between just over one lb. for the fastest models to just over two lbs. for the slow-speed type. They are fitted with hardened and ground steel spindles and

(*Continued on page 1021*)

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1016*)

collet chucks of a design which ensures accurate centring of the cutter shank.

•

Supersonic Wind Tunnel.—A group of companies in the United Kingdom aircraft industry has registered a company —Aircraft Research Association—whose object is to design, build and operate what will be the largest transonic-supersonic wind-tunnel in Britain for testing scale model aircraft. The tunnel will require about 35,000 horsepower. Negotiations are taking place with the Ministry of Supply and other authorities on the siting of the wind-tunnel, the supply of power and other services.

The project was initiated by the technical board of the Society of British Aircraft Constructors, which reported that the progress of aircraft design and development demanded the provision of a large wind-tunnel capable of operating at speeds just below and above the velocity of sound and available to the industry at all times.

The firms concerned are Blackburn and General Aircraft, Boulton Paul Aircraft, the Bristol Aeroplane Company, the Fairey Aviation Company, Folland Aircraft, Handley, Page, the Hawker Siddeley Group, Rolls-Royce, Saunders-Roe, Vickers-Armstrongs and Westland Aircraft.

•

Vacuum Pump.—To meet the demand for a vacuum pump which can be moved around easily in a laboratory, a Pulsometer 1-inch F.R. compact unit has been developed by Pulsometer Engineering Company Ltd., of Reading, England. This, with motor, weighs only 33 lbs. Completely vibration free, it can be run on a bench or table without bolting down. The pump, said "The British Trade Journal and Export World" can be stripped, cleaned and reassembled in a matter of minutes without the use of special tools. Another advantage is that oil immersion has been eliminated, although oil sealing is still required; the reservoir forming an integral part of the unit.

•

Unrustable Vacuum Flasks.—Unrustable vacuum flasks of extruded aluminium, anodised in a series of most attractive colours, and finished with large size plastic cups in cream, have been developed by Thermos Ltd., Seymour Road, London, E. 10.

The glass refill and other components are of high quality and the flask is designed to give long service at a reasonable price.

Another new model is a quart-size jug with a sturdy plastic casing of pleasing and practical design. Of special interest also is a new, capacious ice-bowl fitted with a chromium plated brass canister and lid. All these new products are equipped with a patent shock absorber which protects them against physical shocks and guarantees their safe arrival no matter how long or arduous their journey may be.

•

A Braking 'Brain'.—A new device for fitting to aircraft brakes to assist the pilot in landing and taxying has been developed by United Kingdom designers. At present it is virtually impossible for the pilot to judge accurately the exact amount of brake he has to apply for a given landing. Factors which must be taken into account include the speed of the aircraft, its drag, different types of runway, different climates and different temperatures, the changing weight of the aircraft as more or less fuel and passengers are carried, and the change in weight of the aircraft as it has more or less "lift" at the point of touch down.

The result of such excessive demands on the pilot's speed of thought is that brakes are burnt out quickly and tyres are worn. Indeed, on a modern jet fighter, brakes receive such fierce treatment that they operate at temperatures very close to the limit. Accidentally exceeding the limit may mean a serious accident.

The new device, known as the Dunlop Maxaret, acts as a mechanical brain for the pilot and enables the brakes to be used just to the limit but no more. It does not put the brakes on—but it automatically keeps the wheel turning just the right side of a skid; that is, at its maximum efficiency.

The Maxaret can be fitted to any existing brake on any existing type of

(*Continued on page 1025*)

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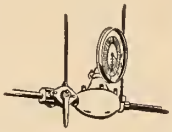

is determined by the type and number of plumbing fixtures in the building, together with the pressure available and the height of the bullding. The solving of this problem in applied hydraulics is a service of the Professional Engineer.

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Most modern offices are completely air-conditioned and this installation is closely allied with that of heating. The Professional Engineer will correlate the problems of heating and ventilating so that the equipment will work in harmony in the interests of comfort.

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(*Continued from page 1021*)

aircraft wheel. It does not have to be modified or adjusted for a particular aircraft. The brain of the device is a flywheel which runs inside a casing at the same speed of the aircraft wheel. When the wheel is slowed down too abruptly, the flywheel overruns and operates a valve which releases brake pressure.

●

Rubber Lining For Reservoir.—The lining of a reservoir with rubber is one of the novel projects being undertaken by the Dunlop Rubber Company's Manchester, England, organisation. It is believed to be the first project of its kind to be attempted anywhere in the world.

The reservoir—750 feet long, 300 feet wide and some 18 feet deep—is underground and has a normal capacity of approximately 20 million gallons. It is sited across a hard rock ridge which has coal deposits on either side and is laid in a bed of sand. The working of these deposits has now caused some major subsidences, which in turn have developed cracks in the reservoir. One of the four sections of the reservoir has had to be taken out of service and the level of the water in the remaining sections considerably reduced.

It is now considered that a rubber lining will absorb the slight movement which causes the minor cracks in the rigid materials and, following discussions between the water engineers and Dunlop technicians, a portion of one of the sections of the reservoir has been lined on an experimental basis. This work has already proved that the application of rubber is a practical and economic proposition.

Preparations are now being made to begin work on lining the mixing chamber of the reservoir and if this is successful the whole of the reservoir will be lined. It is estimated that 200 tons of rubber will be necessary to complete the project.

●

New Nickel Chromium Alloy.—The Birmingham, England, research laboratories of the Mond Nickel Company have produced a new nickel-chromium alloy, Nimonic 95, for the rotor blades of gas turbine aircraft engines. Since the birth of the jet engine these laboratories have produced seven successive alloys for rotor blades—four of them major developments—giving operation at higher temperatures or higher stress, or both.

The new alloy provides the same strength as Nimonic 90, at operating temperatures 50 degrees Centigrade higher. It is already in production at the works of Henry Wiggin and Company, Wiggin Street, Birmingham, and will soon be available in quantity. The rotor blades of every United Kingdom gas-turbine aircraft engine are made by this firm, which also produces 95 per cent. of the flame tubes—made of Nimonic 75.

●

Pharmaceutical Machine.—A new machine claimed by its makers, Fords Ltd., Kempston, Bedford, England, to be the first of its type for making aluminium caps for penicillin, streptomycin and other anti-biotic vials, and for applying and sealing them on to the vials, was being exhibited at this year's British Industries Fair by a Bedford, England, firm.

The particular features of the machine are a capmaking press which will work on aluminium foil of any thickness up to 0.3 millimetres and at any speed up to 10,000 an hour; a hopper feed, incorporating control units to indicate when the hopper is full or empty; a cap applier which will work at any speed up to 6,000 an hour and which incorporates two safety checks to eject any vial fitted with a distorted cap; a spinning unit which ensures caps are spun on to the vials by means of a three-head rotary spinner. Running at fixed speeds of up to 6,000 an hour, the unit is spring-loaded so that vials cannot be damaged or broken during the operation, and is adjustable for rubber bungs of varying thicknesses.

●

New Invention To Save Iron.—An estimated annual saving of hundreds of thousands of tons of iron was foreshadowed at a recent demonstration of a new invention at Crofts (Engineers) Ltd., Bradford, Yorkshire, England.

At present about 15 per cent. of the initial weight is removed from iron castings in the form of swarf or borings. Existing methods of melting the borings are costly, while to feed them into the furnace in the normal manner would mean that they would be blown straight out of the top.

The new apparatus, which acts as a cover to prevent this, can be fitted to a furnace in 24 hours. It is claimed that

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it can make a considerable difference to the iron trade. Crofts workshops produce about 40 tons of borings a week. This means that they lose 2,000 tons of iron a year; and this can now be returned to the foundry as useful iron.

●

"British Tractors And Farm Machinery".—Of interest to overseas buyers of British-built agricultural machinery is a publication entitled "British Tractors and Farm Machinery" (popularly known as the Green Book). This first issue consists of 300 pages and contains more than 600 illustrations of Britain's latest products.

Reports on unofficial tests on tractors, machinery and implements, and information and statistics about the general activities of the industry are included, as well as personalities, and a list of leading manufacturers and suppliers engaged in the United Kingdom agricultural machinery industry. Quarterly supplementary issues will keep the Green Book up to date. The price, including supplements, is 30 shillings per year post-free to any part of the world.

The Green Book is claimed to be the largest and most comprehensive publication covering farm machinery ever issued in any country. Its potential readership is also immense, for overseas agriculturists alone are buying farm equipment from Britain at the rate of some £50 million a year. Publishers are: Norman Kark Publications Ltd., Technical Division, Grand Buildings, Trafalgar Square, London, WC. 2.

●

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Electrical Contacts. — A new 12-page catalogue has just been published by Gibson Electric Company, 8430 Frankstown Ave., Pittsburgh 21, Pa. It describes properties and uses of the Gibson line of electrical contacts. The publication is designed to aid in the selection of electrical contacts throughout all the broad original-equipment fields. Copies may be obtained by writing to the Company at the address given in this item.

●

Carbon Blacks.—Godfrey L. Cabot, Inc., 77 Franklin Street, Boston 10, Massachusetts, are the publishers of a highly informative data sheet "Cabot Reinforcing Carbon Blacks for Rubber". Canadian Sales Agents for the Company, to whom requests should be addressed, are Delacour-Gorrie Limited, 880 Bay St., Toronto, and Delacour-Gorrie Limited, 1178 Phillips Place, Room 201, Montreal. Ask for "Cabot Reinforcing Carbon Blacks for Rubber".

●

Applied Pneumatics. — John Spotton Co. Ltd., 4237 Dundas St. West, Toronto 18, offer Journal readers copies of the publication "The Journal of Applied Pneumatics". This publication is prepared by a leading manufacturer of pneumatic equipment in Britain and is free of all advertising with the exception of their own advertisement on the back cover. Copies may be obtained by writing to the Canadian Company.

●

W. Edwards Catalogue.—Scientific Exports (Gt. Britain) Limited, 50 York St., Toronto, offer copies of a new catalogue and price list released by W. Edwards & Co. of London, England. This publication is the first Canadian stock list of vacuum equipment, complete with up-to-date dollar prices. All the items listed in the publication are in stock at the premises of the Canadian agents. Further technical information and additional leaflets may be obtained from the Company mentioned above or from F. H. Richards, 1197 Phillips Place, Montreal.

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Solderless Terminals. — A new book dealing with quality control of the entire solderless wire termination process has just been published by Aircraft-Marine Products, Inc., Harrisburg, Pa. "A-MP Quality Control" is of special interest to engineers, designers and manufacturers in the electrical and allied fields. It provides technical information concerning 3-way control of the wire termination process from the raw metal, through manufacture, to the finished installation. Requests for the booklet "A-MP Quality Control" will receive prompt attention if addressed to Aircraft-Marine Products, Inc., 2100 Paxton St., Harrisburg, Pa.

•

Compaction Equipment.—A new 12-page brochure on the history of pneumatic-tired compaction equipment has just been released by the Wm. Bros., Boiler and Mfg. Co. of Minneapolis, 14, Minnesota. The first section contains a condensed background of rubber-tired compact developments in the construction of super highways, etc. The second section has results of compaction tests conducted at the Oahe Dam project near Pierre, S. Dak. Details and specifications on the Roll-O-Pactor are in the third section. Copies may be obtained by writing to the Road Machinery Division, Wm. Bros., Boiler & Mfg. Co., Minneapolis 14, Minnesota.

•

Transmission Machinery. — A new book, No. 2392, describing conveying, processing and power transmission machinery particularly adapted to the grain milling and processing industries, has just been published by Link-Belt Limited. It contains information to aid in selection of conveying equipment, including screw conveyors, belt conveyors, bucket elevators, bulk-flo, oscillating conveyors and related components. Copies of the publication will be sent upon receipt of written requests. Address requests to Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8.

•

Power Plant Temperatures. — Instrumentation Data Sheet No. 9.1-11 discusses temperature measurements in power generating stations with the use of Thermocouples and continuous balance type potentiometers. Included in this four page pamphlet are details on the importance of accurate temperature measurement, design details of butt-welded thermocouples, constructional features of continuous balance potentiometers. Illustrations included show the basic thermocouple types and types of potentiometers employed in steam generating stations. For copies write to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont.

•

Flow-Metering.—Two essential tools in flow meter engineering, the Foxboro Flow Rule, which simplifies calculation of primary elements, and "Principles and Practice of Flow Meter Engineering" recognized as a basic text on fluid measurement, are now being offered in a combination purchase by The Foxboro Company, Foxboro, Mass. Specially designed for rapid solutions to problems of line size, flow rate and orifice sizing, the Foxboro Flow Rule has a reversible slide with scales for gas on one side, liquids and steam on the other, each fluid identified by a distinctive colour. Accuracy of the Flow Rule is closer than can be read. Over-all length of the rule is 12". Complete instructions and cowhide carrying case are included.

"Principles and Practice of Flow Meter Engineering" by L. K. Spink, now in its seventh edition, contains 418 pages of tables, curves and text, serving as a one-source reference of important data and an authoritative guide to the correct methods of measuring flow. The Flow Rule and the Flow Meter Handbook are being offered in a combination purchase at $27.00. Bought separately, the price is $7.00 for the handbook and $25.00 for the Flow Rule. Cheques or purchase orders should be sent to Peacock Bros., Ltd., Ville La Salle, P.Q.

•

Recorders and Controllers.—To describe how Speedomax recorders and controllers are being applied to an increasing variety of uses in industrial production and research, Leeds & Northrup Company has just published a revised, 48-page edition of its Speedomax catalogue—"Speedomax Type G Instruments for Measurement and Con-

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For speeding haulage work, cheapness of operation, efficiency for the job and absolute safety for underground work, these Ruston diesel locos are now popular machines for Canadian mines. For narrow gauge tracks, from 1′ 6″ upwards, they are fitted with a foolproof gearbox which operates without foot controls, and the well-known Ruston diesel engine equipped with exhaust conditioner for safe working in mines.

One of the latest Ruston locos, supplied by Agents, Laurie & Lamb is shown above, working at the Falconbridge Nickel Mines Ltd., Sudbury, Ontario.

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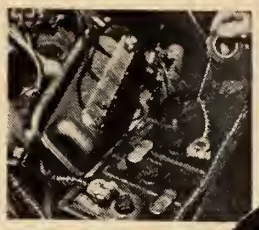

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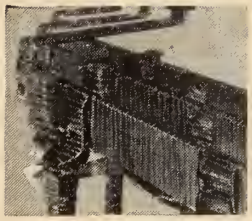

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trol." A copy of the catalogue No. ND 46 (1) will be sent to *Journal* readers upon request. Address requests to the Company at 4934 Stenton Avenue, Philadelphia 44, Penna.

•

Electrical Connections. — Erico Products Inc., 2070 East 61st Place, Cleveland 3, Ohio, offer a 76-page catalogue of Cadweld electrical connections and other products. To obtain copies write to the Company at the address given above.

•

Conveying Equipment. — A newly-revised 28-page catalogue of Rapistan conveying equipment with photos, drawings, and specifications of an enlarged line of power and gravity conveyors, hand trucks, and industrial casters has just been published by The Rapids-Standard Company, Inc., Grand Rapids, Michigan. Copies of the equipment catalogue may be obtained by writing to Rapids-Standard Company Inc., Dept. GC, Rapistan Building, Grand Rapids 2, Michigan. Ask for Catalogue GC-52.

•

W. B. Connor Bulletin.—A new 16 page bulletin—117-C—illustrating and describing its activated carbon air recovery or purification cells has been issued by the W. B. Connor Engineering Corp. The bulletin has been revised to include data on the recently developed Type T-42 C Cell recommended for odor removal applications other than those encountered in ordinary comfort conditioning, such as exhaust and intake problems. For copies write to W. B. Connor Engineering Corp., Shelter Rock Lane, Danbury, Conn.

•

Miniature Ball Bearings.—A new catalogue containing complete specifications on more than 120 different types and sizes of miniature ball bearings has just been issued by Miniature Precision Bearings, Inc., Keene, N.H. In addition to the basic catalogue (52B) additional engineering data sheets covering load ratings, clearances, tolerances bearing installations, etc. may be obtained directly by writing to the Company.

•

Minneapolis-Honeywell.—A new twelve page catalogue No. 1700 covers the use of Honeywell Air-O-Motor Diaphragm Operators with Continental Butterfly Valves. Complete specification data is given for both Standard and Heavy Duty Pattern Valves. Write to the Company at Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont. for copies.

•

Buchanan Electrical Catalogue.—Catalogue No. 52, a 12 page publication, describes the complete line of solderless wire connectors, cable and conduit fittings and wiring devices manufactured by Buchanan Electrical Products Corp. To obtain copies, write to James O. Johnson, merchandise manager, Buchanan Electrical Products Corp., 225 Route 29, Hillside, New Jersey.

•

Carbon Steel Welding. — The advantages of argon-oxygen mixtures in shielded inert gas metal arc welding of carbon steels are analyzed in a new booklet, "Sigma Welding of Carbon Steels."

This twelve-page study includes the effect of gas flow, current density, and welding speed on porosity and the effect of voltage on penetration when using a 5 per cent oxygen mixture. Rod burn-off and metal deposition rates for sigma and flux coated electrode welding are also compared. This booklet may be obtained from Dominion Oxygen Co. Ltd., Montreal, Toronto, Winnipeg, Vancouver.

•

Cleveland Worm Catalogue. — The Cleveland Worm & Gear Company have just issued a new general catalogue No. 400. It contains 180 pages and illustrates and describes each model in the complete line of Cleveland worm gear speed reducers as well as worm and gear sets for built-in power transmission applications.

To obtain copies of this publication, write to Peacock Bros. Ltd., Ville La-Salle, Montreal, Que.

•

C.G.E. Brochure.—A well produced 24-page brochure, entitled "Building Big" is now available from Canadian General Electric Company. It describes the Company's new and greatly expanded facilities at Peterborough for the production of major rotating equipment for electrical utilities.

Printed in four colours and profusely illustrated, the booklet takes the reader on a pictorial tour of the largest self-contained engineering - and - production centre in Canada for the manufacture of waterwheel-driven generators and

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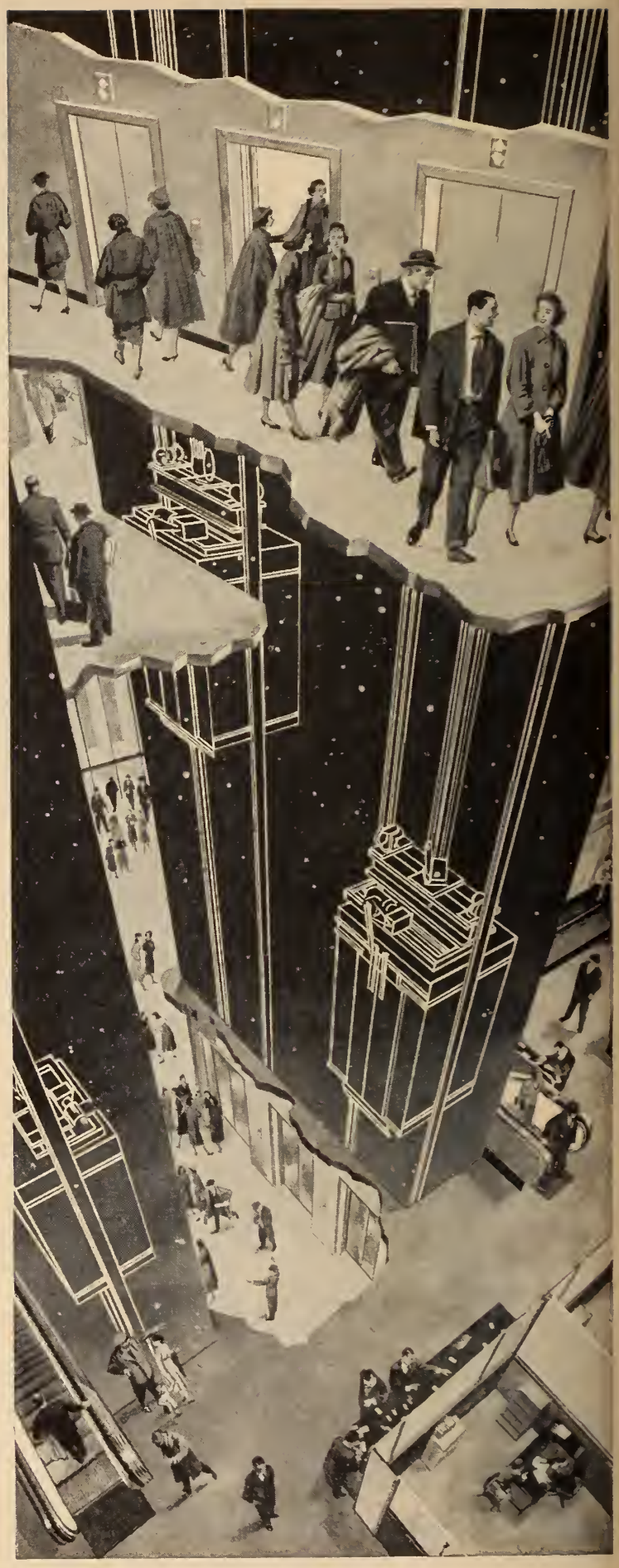

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synchronous condensers. A feature of the brochure is a double-page full-colour sketch of a large generator, showing in cutaway fashion many design features. Engineers, universities and company librarians should send their requests to their nearest C.G.E. office, for copies of the booklet.

•

Wheelco Data Book.—A new 42 page 1952 edition of the Wheelco Data Book and Catalogue has been released by Wheelco Instruments Div., Barber-Colman Company, Rockford, Illinois.

Among the many items listed in the convenient table of contents are resistance bulbs and wells, radiation detector, special thermocouples for plastic injection and extrusion machines and a molten metal thermocouple for ferrous metals. Write to the Company and ask for Bulletin TC 9.

•

Concrete Poles.—A bulletin describing concrete poles has just been released by Canadian Line Materials. It is designated as bulletin No. PL 952 and it presents C-L-M "Tec" poles in detail. These poles are used for street lighting, power distribution, sign poles and trolley structures. The bulletin may be obtained by writing to Canadian Line Materials Limited, Toronto 13, Ont.

•

Cable Reel Jacks.—Cable Reel Jacks for lifting and holding heavy reels are featured in a new two-page bulletin published by The Duff-Norton Manufacturing Company. Designed for handling cable reels from 20 to 90 inches in diameter, these jacks are available in capacities of 5, 10 and 15 tons. To obtain copies write to the Duff-Norton Manufacturing Company, Pittsburgh 30, Pa., and ask for Bulletin Ad 26.

•

Corrosion-Proof Cements.—A new bulletin providing technical data and catalogue information on the four basic types of corrosion-proof cements has just been released by the Atlas Mineral Products Co., Mertztown, Pa.

Included in the new bulletin are charts showing the temperature range of each cement and its resistance to broad classes of corrosives. Resistance tables rate each cement specifically for 176 common chemical materials. Copies of the new bulletin No. 5-2 are available from Atlas Mineral Products Co., 33 Walnut Street, Mertztown, Pa.

•

Elevators.—Turnbull Elevator Co. Ltd., 126 John Street, Toronto, are the publishers of a magazine "Going Up". The May-June, 1952 issue is devoted to the description of elevated parking areas, and garages. To obtain copies of this and other issues write to the Company at the address given in this item.

•

Forano Catalogue. — A new 40 page catalogue on Herringbone Gear Speed Reducers is now being distributed by Forano Limited, Canada Cement Building, Montreal and Plessisville, Que.

This up-to-date publication gives full details and specifications on single, double and triple horizontal and vertical reducers manufactured by the company, to transmit up to 600 h.p. Send requests for the catalogue to the company at Montreal.

•

Leeds & Northrup Catalogue.—To present its complete line of standard thermocouple assemblies and parts, Leeds & Northrup Company has just published a newly-revised and illustrated 44-page catalogue No. En-S2. The title of the catalogue is "Thermocouples — Assemblies, Parts and Accessories". To obtain copies write to Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44, Penna.

•

Warden King Centennial. — Warden King Limited have issued a beautifully produced brochure to mark their first 100 years of operation. The brochure traces the history and expansion of the Company and it is well illustrated with cuts of old and new products and plant interiors of yesterday and to-day. Copies may be obtained by writing to the company, Warden King Limited, 2104 Bennett Ave., Montreal, Que.

•

(*Continued on page 1039*)

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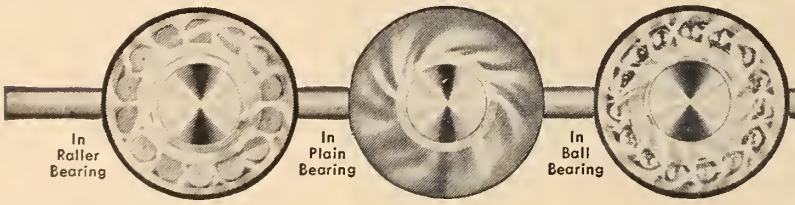

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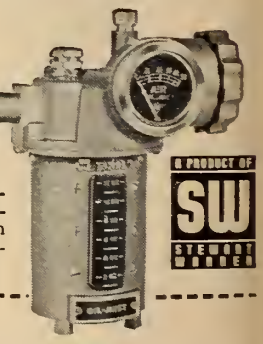

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(*Continued from page 1031*)

Hydraulic Coupling. — The Twin Disc Company's new disconnecting hydraulic coupling — which combines the shock-absorbing advantages of a fluid drive with the disconnecting features of a master clutch — is described in Bulletin No. 500 just released.

The Bulletin presents diagrams of the Model HUD, explaining the fluid dumping feature which disconnects the output shaft from the source of power. Cooling circuits are illustrated. A horse-power range chart is included in the Bulletin. To receive a copy write to Twin Disc Clutch Company (Hydraulic Division) Rockford, Ill.

●

Power Wheel-barrow. — Construction Equipment Company Limited, 180 Vallee Street, Montreal, offer a bulletin describing MOTO-BUG, a power wheelbarrow manufactured by Kwik-Mix (A Koehring subsidiary).

The newsworthy feature of this equipment is its exceptional versatility. Any basic unit may be equipped with four front-end attachments which are fully interchangeable — simply and quickly. To obtain copies of the bulletin write to the Company.

●

Roller Chains. — Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, Ont. has issued a new 148-page roller chain engineering data book. It is designated as No. 2457-C. The publication is highly informative and contains engineering data on the selection, installation, lubrication and maintenance of roller chain for drives and conveyors, and sprocket wheels. Write to the Company and ask for the bulletin by number.

●

Butterfly Valve. — A pneumatically operated butterfly valve for control of air, water or steam flow has been developed by the Industrial Division of Minneapolis-Honeywell Regulator Company.

The pneumatic valve motor is described as a Grad-U-Motor power unit. It operates on a controlled air pressure range of zero to 15 p.s.i. Adjustable mechanical stops provided on the motor enable the wing rotation to be limited for special application.

The valve is sized from 1½ to 6 inches, with screwed connections. Body, wing and trim material is bronze. Maximum operating temperature is 250 degrees F; maximum pressure, 20 p.s.i.

Address requests for copies of descriptive booklet to Minneapolis-Honeywell Regulator Co. Ltd., Leaside, Toronto 17, Ont. Ask for specification sheet No. 420.

●

Wood Treatment. — A new industrial specifications folder for wood treatment with pentachlorophenol is available upon request by writing to the Dowicide Sales Department, Dow Chemical of Canada, Limited, 204 Richmond Street West, Toronto 1, Canada. The specification covers piling, transmission poles, cross and switch ties, crossarms, structural lumber and millwork.

●

C-I-L Technical Bulletins. — Canadian Industries Limited, Box 10, Montreal, offer the following highly informative bulletins and brochures. When requesting copies please mention the number as well as the title of the bulletin.

Bulletin A-3: "The Molding of Plaskon Alkyd".
Bulletin A-5: "Plaskon Alkyd".
Bulletin A-7: "Properties and Uses of Molded Plaskon Alkyd".
Bulletin A-10: "The Molding of Plaskon Fibre Glass Reinforced Alkyds".
Bulletin No. X-7: "Teflon" Tetrafluoroethylene Resin Molding Techniques".
Bulletin No. X-19: "Alathon" Polythene Resin Molding Techniques.
Bulletin NX-10: "Teflon" Tetrafluoroethylene Resin Aqueous Dispersion TD-1.
Bulletin X-13: "Method for Producing Experimental Injection Molds."
Technical Service Bulletin No. 8B: "Injection Molding of Nylon".
Technical Service Bulletin No. 21: "Nylon in Gears and Bearings".
Alathon Polythene Resins for Paper Coating and Specialty Applications. (This is a combination of bulletins and no number is required).
Bulletin No. C-1-152-T: "How to use Koppers Penacolite Adhesive G-1260".
Dupont "Teflon" Tape for Electrical Insulation. (No number required).
"Teflon" an outstanding new material for gaskets and packing in the chemical industry. Ask for Bulletin A-478.
"Dupont Nylon Molding Powder". (No number required).
"Perspex" Acrylic Materials. (No number required).
Design Factors for Large Thermoset Moldings. (No number required).

Some of these publications are of an expensive nature and it is suggested that applications for copies be made on official letterheads. ●

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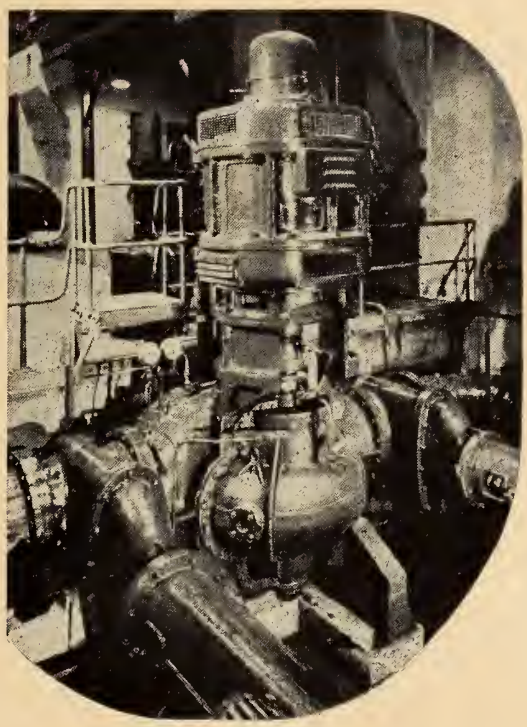

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★ ★ ★

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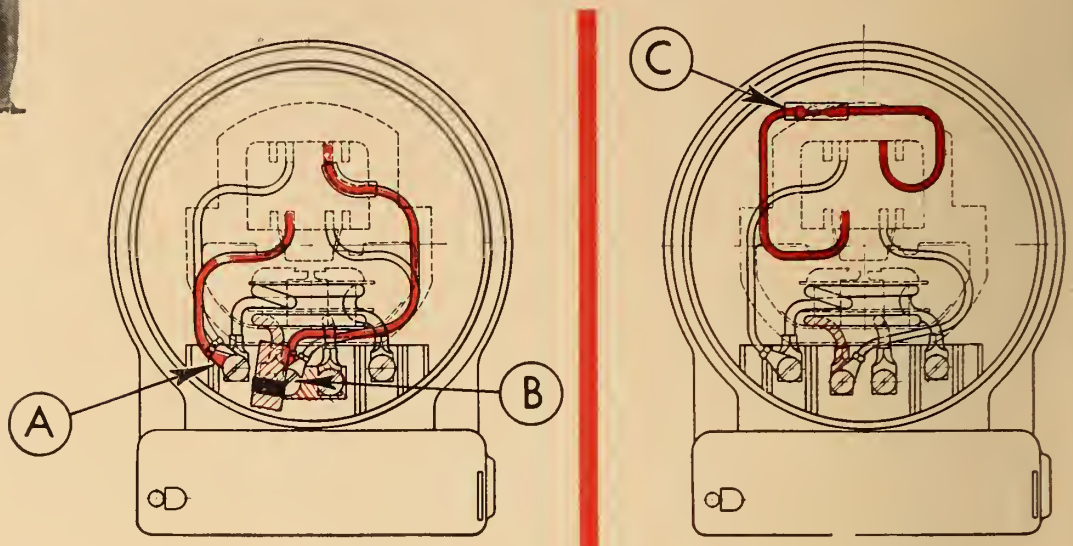

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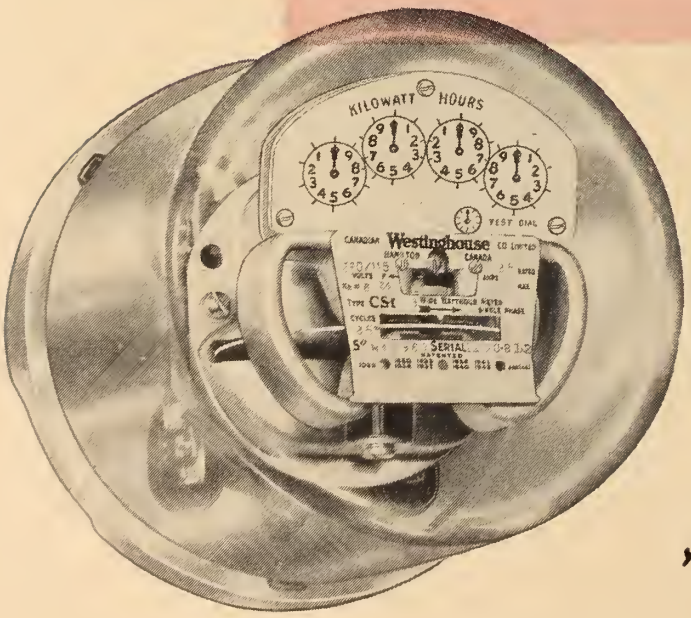

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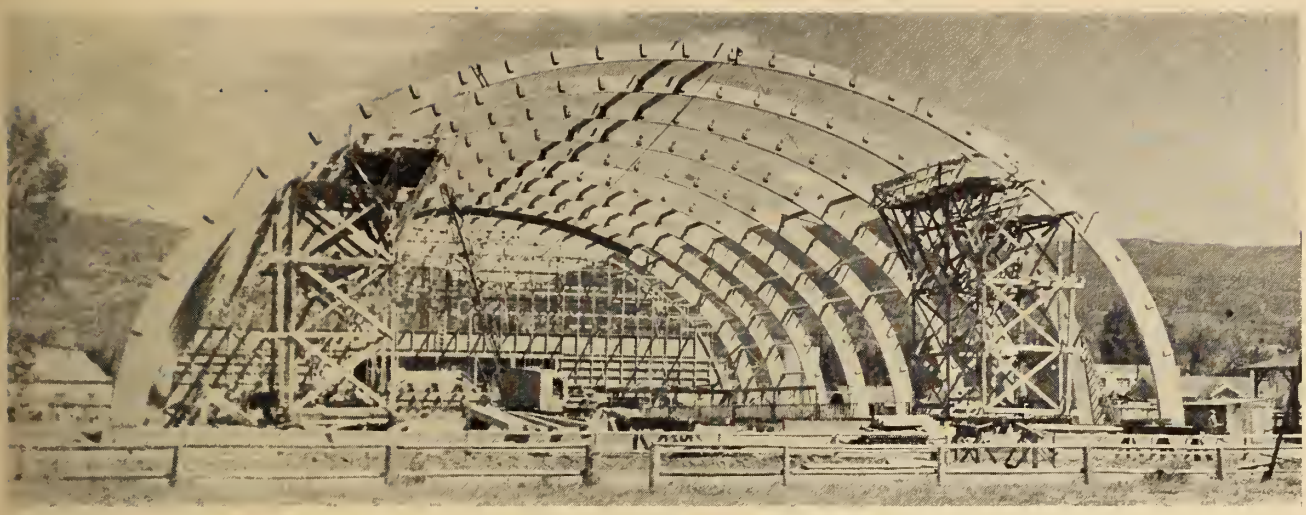

Fig. 1. Glued laminated arches of 140-foot span used in an arena at Penticton, B.C.

Structural Timber

by

W. Thornber, M.E.I.C.

Timber Development Engineer, B.C. Coast Woods, Vancouver.

A paper presented to the Sixty-sixth Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver B.C., May 9, 1952.

The author reviews the grading, stressing, performance and maintenance of sawn structural timbers, with particular reference to Pacific Coast woods.

He outlines briefly the current forest situation on the Pacific Coast where the annual cut for all purposes consists approximately of 50 per cent Douglas fir 21 per cent Pacific Coast hemlock, 20 per cent Western red cedar and nine per cent for other species.

Engineering in wood, he says, has two major handicaps; first, little instruction is given in it in most engineering courses, and second, design data and technical literature, while voluminous, are not neatly consolidated. Trade associations are showing increased interest in removing these handicaps.

To bring the sawmilling industry and its problems on the Pacific Coast into focus, it is necessary to outline briefly the current forest situation. The present coastal forest is estimated to contain 24 per cent Douglas fir, 30 per cent Pacific Coast hemlock and 26 per cent Western red cedar, leaving 20 per cent for other species. The annual cut for all purposes consists approximately of 50 per cent Douglas fir, 21 per cent Pacific Coast hemlock, 20 per cent Western red cedar and nine per cent for other species. These figures include requirements for the plywood industry which is almost entirely Douglas fir and for pulp logs which run heavily to Sitka spruce and Pacific Coast hemlock. Our long-term forest utilization problem is to market common grades of cedar.

The sawmilling industry on the coast is geared almost entirely to old growth timber of considerable size. This is supplied in large part from an over-mature forest which is no longer growing economically. There are still large stands of this forest and it appears that with planning our present rate of forest depletion can be maintained indefinitely. However, the new, second-growth forest will never produce trees of the present size for economic reasons.

Of our 2½ billion board foot annual sawmill cut, the sawlogs from 24 inches to 40 inches diameter at the top produce the bulk of higher grades of timber products. These come from choice old growth stands. Approximately 8 per cent are clears and about 15 per cent are structural or select and the bulk of the remainder are ordinary construction grades in such familiar items as boards, dimension, plank and timber. Our forest is being cut from lowlands to highlands and this, together with the demands of the plywood industry, results in a decreasing proportion of prime logs for sawmilling. This condition requires that grading be carried out in a systematic manner. Indeed, one of the main objectives of the British Columbia Lumber Manufacturers Association is to promote efficient grading and consequent quality control at all stages of sawmilling.

In the past, the characteristic variations of wood were not so important as they are today because lumber was cheaper and easily obtained in large sizes and almost clear grades. The use of clear grades practically eliminated defects and avoided many problems caused by variability of lumber. Plentiful supply, moreover, resulted in the use of larger sizes than economical design would indicate. Conditions have changed. By experiment, the structural values of various grades have been determined and the requirements of modern construction for strict economy in design have been

met with advancing knowledge of wood technology.

The establishment of a grade requires the co-operation of producers to turn out a standardized product suitable to fill a definite requirement by consumers. For structural timbers these grades are set by the Canadian Standards Association through its Committee on Structural Timbers. By this means, the quality of timber supplied according to this specification applies throughout Canada and with minor deviations throughout the U.S.A. Two grades of structural timber are established, "Select Structural" and "Structural" being respectively 75 per cent and 60 per cent grades as will be defined in detail later. The C.S.A. Committee on Structural Timber stipulates minimum requirements for the grade; since logs run to type, and because of manufacturing practices the bulk of the lumber for any grade is well above this minimum. The National Building Code, which will reference this specification, is also a code of minimum and essential requirements.

Wood is a product which does not conform to the simple stress relationships of homogeneous materials. Its properties relate to its fibrous structure, its wide variation in resistance to different kinds of stress and to the natural characteristics it may contain. With rare exceptions, defects are visible and form the basis for grading. In timber there is a certain elasticity in the rating of defects and the equivalence of one defect in terms of another is accepted practice. The C.S.A. lays down the maximum defect of each kind permitted in a piece but depends on the equivalence practice to ensure that not all maximum permissible defects are present together at any section. In an efficient mill, grading starts with the head sawyer and continues in all subsequent operations in order to produce the highest grade of material possible. At the customer's discretion, grade inspection of structural lumber may be done by the mill or by an independent agency. Well graded lumber promotes the entire industry.

Structural timbers are in three categories: Joist and Plank; Beams and Stringers; and Posts and Timbers. That is, grades are established on the basis of the most probable end use for a piece selected in any one category. Other usage, such as joist material used as truss web members, requires some selection during fabrication. For this reason the C.S.A. Committee on Structural Timber has recently defined a regrade rule for the selection of tension members to justify a higher permissible stress in axial tension.

In any timber category, permissible defects are related to the length, width and depth of piece. It follows that any considerable change in these dimensions may change the grade. This is particularly true for large timbers being re-sawn or for long pieces being cut to other lengths. While, in general, the price differential favours the ordering of random lengths and widths of wood products, in the case of structural timber this can be done only with precise knowledge of suitability for end use.

To sum up grading from the engineer's standpoint:

(1) Grading provides a reliable standard in definite end use categories in all grades and structural grades in particular.

(2) Grading places the responsibility for satisfactory structural timber on the producer. Properly graded lumber can be misused.

(3) It is highly desirable that the supervisors and foremen carpenters have some basic knowledge of grades or understand the influence of the various characteristics of timber.

Because a large part, about 70 per cent, of Pacific Coast production is for export, our mills are adept at grading to varied and exacting specifications. Similarly, they are experienced at cutting to required dimensions. Because this coast produces the bulk of structural timber for Canada we are interested in the structural uses of timber and the strength characteristics assigned to it.

The two structural grades are assigned permissible stresses (75 per cent and 60 per cent respectively) expressed as a percentage of basic strength figures for clear specimens of the species, the mark down being dependent on their respective permissible defects.

Basic stresses for clear material are determined from average strength properties as determined by Forest Products Laboratory tests, with modifying factors. Frequency-strength graphs of tests for any physical property show a typical inverted (U) probability curve. Therefore, the first modifying factor (about ¾) is for variability. Although timber is resilient and has a high capacity for short term and shock loads, it is plastic under long term loads. Therefore a permanent load factor (9/16) is introduced. From observation and experience it has been found that various species react differently when subjected to differing stress conditions and a weighted factor of safety is therefore incorporated. Applying these combined reductions to the experimentally determined average strengths gives the basic working stresses from which allowable working stresses are derived according to grade and species. The entire pro-

Fig. 2. A composite timber-concrete aircraft parking area over two acres in extent at Vancouver, B.C., rests on creosoted timber piles and caps.

cedure is done by the Forest Products Laboratories. American and Canadian laboratories are substantially in accord on these values and co-operate in exchange of information.

The allowable working stresses for both structural grades are presented by the C.S.A. Specification on Structural Timber as presently revised and are for timber in the green condition. They are approximately 10 per cent higher than previous figures.

Also included in this specification are tables of modifying factors for dry usage, various exposure and decay hazards and a table for short term loading permissible stress increases. Since the latter is a new departure in this specification it is worth comment. Duration of load is defined as the period of continuous application of full design load or the aggregate of periods of intermittent applications of full design load. Increases are based on permanent loading values and are not cumulative. They do not apply to the Modulus of Elasticity and consequently do not affect design based primarily on deflection limitations.

Loading	*Per cent*
Permanent Loading	100
3 Year (U.S. Normal loading)	110
2 Months	125
7 Days	133
Wind or Earthquake	150
Impact	200

The C.S.A. Specification on Structural Timber gives further design data. All such data presumes sound engineering analysis and design, together with a reasonable amount of care in fabrication and maintenance. Some of the unique characteristics of timber are relevant to both design and maintenance and are treated at this point for convenience:

(1) Wood is almost entirely free from dimensional changes due to temperature variations. For short periods it can withstand extremely high temperatures with but slight damage and does not melt or soften during high temperatures.

(2) Timber changes considerably in section and negligibly in length with changes in moisture content. Regardless of initial condition, the moisture content tends to stabilize according to ambient humidity. The conditions of initial drying affect the degree of dimensional change. Uneven drying may produce permanent deformation in timber. Normally, drying "in situ" of structural timber erected green is fairly uniform and consistent.

Fig. 3. This bridge on the Trans-Canada highway near Hope, B.C., features creosote timber construction with a composite timber-concrete deck.

(3) Timber shrinks unevenly with reduction in moisture content. This may produce ruptures or checks which may occur anywhere in the piece. Allowance in safe working stresses is made for normal checking. Abnormal checking is likely to be forecast by grain conditions and distortion of the piece. Since most structural timber, with the exception of very large sizes, is side cut and does not include the pith, checks tend to occur across the narrow dimension and seriously affect only longitudinal shear, particularly in beams.

Due to the fibrous nature of timber an "end effect" over beam supports is effective. It is found that the theoretical vertical shear concentration over supports is dissipated over such a portion of the beam that the greatest shear concentration is only about 60 per cent of the theoretical maximum and does not occur over the support. The damaging effect of normal end checks is therefore negligible. This point has been emphasized since there are two types of beam tables, some including and some excluding this "end effect".

(4) Checking does, of course, affect the strength of bolts and mechanical fastenings. Methods exist for minimizing their occurrence or correcting for extreme cases. Placement directions for fastenings assume normal end checking.

(5) Decay occurs in wood only within certain limited conditions. The fungi that cause decay require air, water and some warmth. Air-dry wood will not decay and in fact with wood at 25 to 30 per cent M.C., decay is greatly retarded. Decay is optimum with most common fungi between 75 deg. F. and 90 deg. F., falling off rapidly above that figure and more slowly at lower temperatures.

A considerable number of chemical treatments are available to reduce the possibility of decay and selection depends on the exposure and decay hazard, since in some installations leaching of preseratives is in itself a hazard. Most preservatives give relative immunity to insect attack but not all control mould stain. Mould is usually an indication that conditions are right for decay but does not of itself weaken timber. Attack by marine borers requires creosote treatment and to date pressure creosote sets the standard for preservatives.

(6) In heavy structural timber, fire hazard is a calculable item. Fire resistance should not be confused with incombustibility or with flame spread, which are also controllable qualities in timber. There appears to be considerable misconception on the fire resistance of heavy timber and mill construction structures.

The question of fire in buildings is too vast a topic to discuss here in detail. However, three items may be pointed out:

(a) The incidence of fire is closely a function of the tinder and kindling content of a building; fire intensity is related to bulk fuel content and this normally refers to the goods housed.

Fig. 4. A school gymnasium in North Vancouver shows the use of conventional timber trusses and built-up columns. The roof is tongue and groove cedar plank.

(b) Materials used in the main structural elements are important but not more so than exits, general design and layout, fire bulkheads and fire fighting facilities, etc.

(c) Structures may be over-designed for their real fire risk and consequently too expensive, particularly where obsolescence is a factor.

In light of these items, structural timber can be evaluated. Above about ⅜ inch thickness wood cannot support self-contained combustion. Although at about 250 deg. C. wood will decompose to produce inflammable gases or ignite; in heavy timbers the formation of charcoal limits burning to about one inch depth in 33 minutes and without any grave reduction in the strength values of the residual wood despite high temperatures. The fire resistance ratings for sound wood are listed in various building codes and publications. Decayed wood ignites at lower temperatures. The ignition temperatures can be increased, flame spread and rate of penetration can be reduced by chemical impregnation. Surface fire-resistive paints suitable for many conditions are also available. Savings due to timber construction may well be applied to fire fighting devices, particularly where goods housed are inflammable.

These various characteristics of wood form the background for adequate inspection and maintenance of timber structures. With careful maintenance for a reasonable time after erection, the cost thereafter is very low. At the early stages, inspection and maintenance should be the most competent available. As timber structures become accustomed to their loads and approach their equilibrium moisture content, all fastenings should be tightened, otherwise joint strength will suffer. Servicing periods will depend on timber sizes and drying conditions. The most serious situation in timber structures is the separation of joint members. The structure should be checked for local failures particularly at critical points, misalignment of members, loss of camber or signs of movement.

Invariably local failures are accompanied by some visible evidence such as split members, pulled or twisted joints, exposed bright wood, broken paint lines and elongated bolt holes. A fundamental rule is that where there is no visible sign of distress there is no movement and where there is no movement there is no failure. Periodic inspection gives adequate protection.

Timber gives plenty of warning if failure or overloading is likely either by "talking" or by movement. Particularly in underground work, where loads far above normal may occur gradually, timbers which are noisy are favoured. Some settlement is expected in trusses, beams and like structures. This may be considerable during the early life of the structure but should progressively decrease. This settlement under load should become negligible and only if maintained as a measurable quantity is the structure to be considered unsound.

Where decay is a potential hazard, maintenance should be more frequent and painstaking, particularly if mechanical fastenings are involved. With the variety of preservatives now available, only short term structures can afford to neglect such treatment if a potential decay hazard exists.

Paint troubles almost invariably concern water. Usually this occurs when wood is painted wet. This causes poor initial adhesion and with green wood tends to trap moisture which later forces its way out. On new wood, visible sap streaks or knots should be brushed with turpentine or shellac just prior to painting. For normal repainting all loose scaled paint should be removed and rough checked surfaces lightly sanded.

From the above remarks, timber may appear to entail a large amount of maintenance. Actually the overall maintenance for sawn timber structures is very low by any standard. Much of the foregoing applies to glued laminated structures, but many of the problems are transferred to the glulam fabricator and consequently active maintenance is further simplified.

Prof. Carson Morrison is the author of a recent article in *The Engineering Journal* on the subject of glued, laminated, structural timber and it is not proposed to enlarge on the phases of the subject he covered at that time. However, there has been increasing use of this material in Canada lately and its position today compares with solid sawn timber plus its inherent advantages.

Recently, a C.S.A. committee was formed to set a standard for glued, laminated, structural timber. The following is a brief outline of the probable coverage of this specification. As in many other manufactured materials, the technical knowledge, experience and integrity of the manufacturer are the main safeguards of quality.

In its present stage of development, glulam timbers are tailored for a known end use and the strength characteristics can be fitted accordingly. In the sense of grading as applied to sawn timber, it is not logical to assign grades to this built-up product except in the matter of appearance. However, grading control of laminate stock is essential.

Close examination of the problem showed that existing joist and plank

structural grades did not fulfil the requirements of laminate stock without re-selection. Accordingly, four separate grades of laminate stock, based on the percentage of clear material at any section, were defined. Design of glued, laminated, structural members is concerned largely with the use and placement of these grades, and the underlying principles of doing this are to be included in the specification.

The entire specification considers the problem of inspection and back checking at all stages of manufacture. The fabricator is responsible for re-grading and marking of laminate stock, sizing and jointing of laminates, allowing inspection during lay-up, providing the necessary wood moisture content and temperature conditions as required, supplying details of glue characteristics, glue application and curing. Adherence to the requirements of this specification ensures a degree of quality control and inspection facilities which will be an asset in the furtherance of this product.

Since laminate stock is dry at selection and assembly, and the finished product is also dry, and since wood defects are dispersed, discontinuous and under control, the basic stresses for clear material upon which grade stresses are based can be raised very considerably over sawn timbers. The strength of the finished product, which is not itself graded, is therefore a design function. In Canada all stress values for glued, laminate stock are to be raised, except the modulus of elasticity.

The utility of glued, laminated products is enhanced by their almost unique property of being shaped to the most efficient or architecturally desirable form. Their relative efficiency is thereby increased.

Because glulam products are of dry material the maintenance associated with seasoning is negligible. With a properly selected glue the probability of de-lamination under any degree of exposure is very small. Only one common glue used in structural members, casein, is subject to decay unless it contains an inhibitor. Its use is restricted in terms of exposure. Pressure treatment by preservatives is common and satisfactory practice. Heavy structural glulam members have the same slow-burning characteristics as sawn timbers, do not delaminate with heat and the glue does not burn or perish faster than the wood. Many glulam structures have fewer joints than sawn timber structures and their initial settlement is correspondingly less. In structures and individual members, camber is easily incorporated. Generally, maintenance of glued laminated products is not considerable

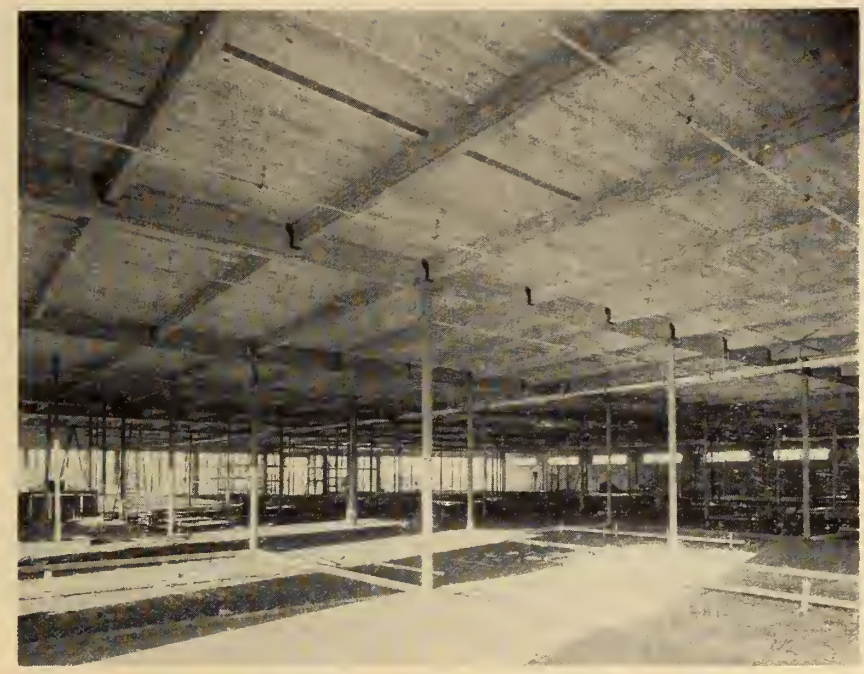

Fig. 5. A large warehouse in Portland, Oregon, which features glued laminated beams and purlins with heavy plank roof deck.

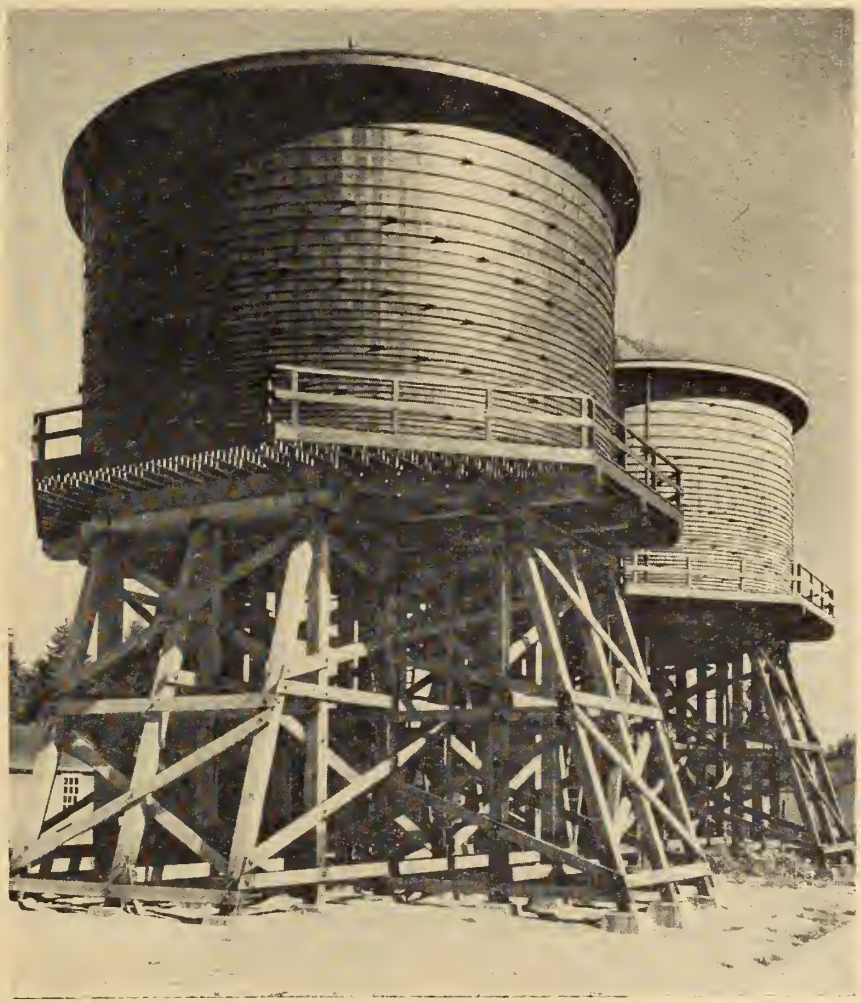

Fig. 6. Two 150,000 Imperial gallon tanks used in the University Hill water supply system, Vancouver, B.C.

and may well be less than for sawn timbers.

Today and for some time it is unlikely that glued, laminated products can compete economically with sawn timbers except under extraordinary conditions and for unusual requirements. Pacific Coast sawlogs are cut mostly in 32 ft. and 40 ft. lengths but some mills are capable of handling 50 ft. lengths and longer. The base price is based on 20 ft. lengths and 12 inch widths, a fact that eastern designers tend to overlook. In large sections and long lengths, together with built-in camber and built-up shapes, glulam products may increasingly replace large solid sawn timbers. Its main field now is in shaped members.

Presently, engineering in wood has two major handicaps. First, little instruction is given in it in most engineering courses, and second, design data and technical literature, while voluminous, are not neatly consolidated. Trade associations, including the British Columbia Lumber Manufacturers Association, are showing increasing interest in the correction of both items.

Summary

(1) For economic reasons, clear high grade large timber is becoming increasingly scarce for sawlogs.

(2) Lumber grades are based on the most probable end use and the bulk of any grade is so used. It is in the interest of the industry to grade carefully. Any major deviation from the probable end use of a grade requires selection on the job. In general, ordering of specified sizes and lengths is advisable in structural grades.

(3) The allowable working stresses for timber have been raised slightly.

(4) Maintenance of timber structures is most important up to and including the condition of final seasoning in place.

(5) The techniques for glued laminated products are established and this industry should increase in importance.

(6) On the basis of performance and price, timber construction warrants close examination by engineers.

Appendix

(1) C.S.A. Specification for Structural Timber 0.43—1952.
(2) C.S.A. Specification for Glued-Laminated Timber Construction—not yet issued.
(3) C.S.A. Pole Specifications 0.15, 1 and 2, 1950.
(4) C.S.A. Pole Specifications C.15, C and E, 1948.
(5) C.S.A. Specification for Round Timber Poles A56—1942.
(6) C.S.A. Specification for Wood Preservatives—not yet issued.

N.R.C. Annual Report

In the National Research Council laboratories at Ottawa, according to N.R.C.'s thirty-fifth annual report tabled in Parliament earlier this year, emphasis during the year was largely on aeronautical, building and radar research, as these three fields are most closely associated with the defence production program. Physics, chemistry and biology, too, had a part in this work although their activities also included substantial amounts of fundamental research.

The Technical Information Service answered 400 inquiries a month, and has also issued 24 special reports on some subjects of general interest, with favourable comment.

Research in chemistry, physics and medicine was continued by post-doctorate fellows and graduate students working at N.R.C. and at universities in Canada and elsewhere, with N.R.C. grants.

The Prairie Regional Laboratory of N.R.C. at Saskatoon, is primarily concerned with investigations designed to promote new and effective industrial uses for agricultural products. The Maritime Regional Laboratory at Dalhousie University, Halifax, N.S., was recently officially opened.

The Annual Report tells of the work of the Laboratory Divisions. Aeronautical research and test work for industry and the R.C.A.F. was increased. Building research studies have included soil mechanics and foundation problems, the relation of climate to house heating and insulation, revision of the National Building Code, and research in co-operation with Central Mortgage and Housing Corporation.

Research in chemical engineering has yielded a means for the simultaneous drying and thermal cracking of bitumen from Alberta tar sands. Studies also concern corrosion, paints, textiles, detergents, and other subjects. In radar and electrical engineering research, assistance was given in the extension of Shoran geodetic triangulation to the Canadian Arctic coast. Microwave beacons for lake and coastal navigation were further developed. Electronic tubes were studied with the object of developing tubes with a useful life approaching the theoretical.

Food investigations in their biological, biochemical and engineering aspects constitute the major part of the work in applied biology.

Two spheres of activity were started in physics during the year: low temperature and solid state physics, and photogrammetry.

Copies of the 35th Annual Report which mentions hundreds of projects of the Council's nine Divisions, are obtainable on request from the National Research Council, Ottawa, Canada.

The report also contains an account of the year's activities in atomic energy research at Chalk River. It may be recalled that, effective April 1, 1952, responsibility for operating Canada's Atomic Energy Project was taken over from N.R.C. by the newly formed Crown Company, Atomic Energy of Canada Limited.

Pakistan Resources Inventory

Canadian capital and Canadian personnel, employing aerial survey methods utilized extensively in this country, will provide Pakistan with an inventory of its natural resources. Under provision of the Colombo Plan, on the suggestion of Pakistan, the work was undertaken, and a contract has been awarded to the Photographic Survey Corporation of Toronto, extending over a period of four years. Although the mapping should be completed by the end of 1954, geologists will return to Canada on completion of the field work and prepare their reports. Results of their studies, extending over an area of some 123,000 square miles, will then be plotted on maps that will be accompanied by a geological report for the Government of Pakistan. This, together with all materials, maps, photographs and preliminary reports should be submitted by the end of 1956.

In undertaking any program to raise the standard of living in underdeveloped countries, it is necessary to determine the extent and character of their natural resources, such as soils, available water supplies, forests, minerals, fish and game. After combining this detailed information with data on climate, existing communications and the distribution of population, it is possible to formulate an intelligent development plan. Resources offering the best potential for immediate development can be selected, and the problem of directing the establishment of industries is greatly simplified.

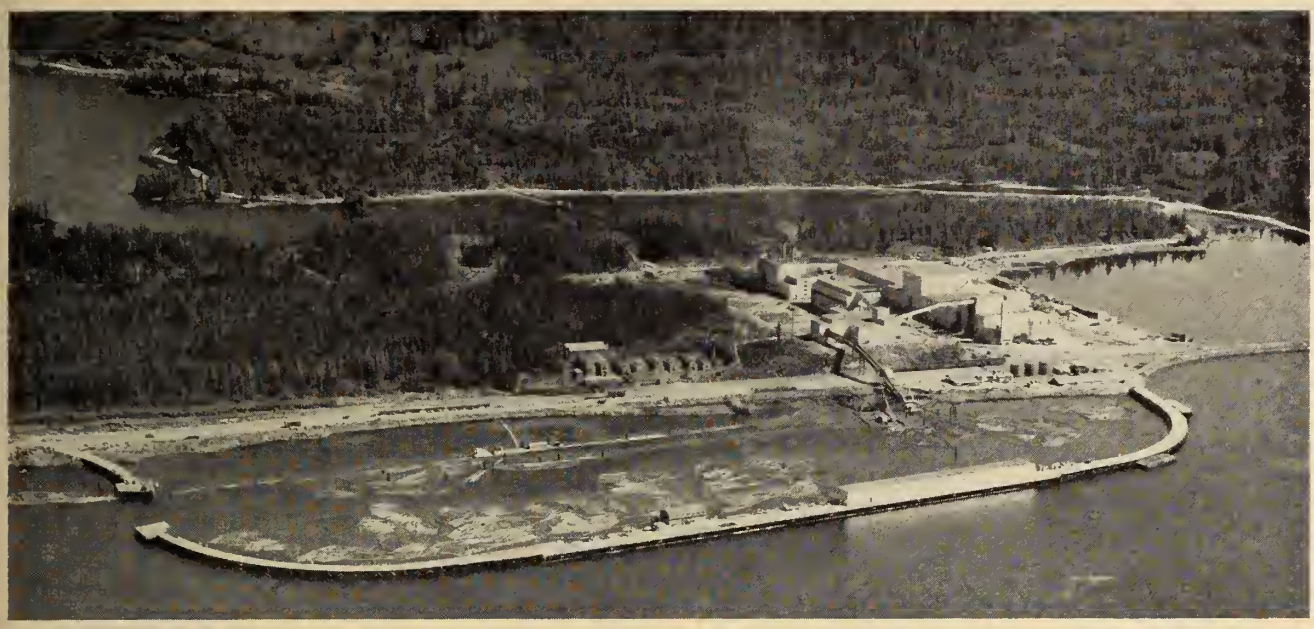

Fig. 1. The Columbia Cellulose Company Limited dissolving pulp mill at Watson Island near Prince Rupert, B.C.

Planning and Construction of the Columbia Cellulose Mill

by

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

The unique features of a pulp mill on Watson Island, nine miles south of Prince Rupert, B.C., and the special problems of supply and construction are discussed in this paper.

The author mentions the difficulties encountered in obtaining laborers and tradesmen, special problems of camp operation, the establishment of a field purchasing group and policy set with regard to design. He also tells how the shortage of bricklayers in B.C. and the heavy rainfall influenced the decision to use precast, concrete wall panels.

In order to safeguard the company's supply of wood pulp—one of its major raw materials—Celanese Corporation of America decided early in 1947 to build a pulp mill. The site chosen was Watson Island, nine miles south of Prince Rupert, B.C.

The Celanese Corporation of America management, through its affiliate, the Columbia Cellulose Company, laid down two over-all policies at this initial stage. The first was that Columbia Cellulose was a Canadian mill to be constructed with Canadian material and labor in so far as possible. The second was that the city of Prince Rupert was to be the base of operations and that nearby existing facilities were to be used before going afield. The obvious soundness of these policies resulted in our receiving wholehearted support from the City, Province and Dominion. To indicate the degree to which the policy was carried out, only six "Yankees" were employed on the project when it was decided to do the construction with our own forces.

It took approximately one year to complete arrangements for the issuance of the forest management license. During this period, engineering studies were carried on in the office of the company's consultant, Stadler & Hurter in Montreal, while on the site field studies were made and the rough excavation was completed. Celanese research forces were very active during this time and the results of

Fig. 2. Steel and concrete takes shape on mill buildings.

the pilot plant operations in Cumberland, Maryland, over a period of years were the basis of important process innovations that were incorporated into the design.

The field studies were: (1) a survey for the waterline, (2) water quality and its variation with the seasons, (3) an investigation of the source of aggregate for concrete work, and (4) railroad trackage arrangement.

The waterline survey was initiated in order to establish the most economical route, and to prepare maps to provide the basis for land purchase and for obtaining bids from contractors. The survey work indicated that tunnels would be required if a pumping station at our dam were to be avoided. It was then decided to proceed with an exploratory tunnel 100 ft. long to gather information to help the various contractors in preparing their bids. As a result of this work it was found that very friable rock was involved and the cleanest break, with a minimum of overbreak, was obtained using a pattern of 19 holes, drilled 8 ft. deep.

Very high quality water was a basic requirement in order to produce satisfactory dissolving pulps. The high color, low turbidity and low hardness of the local water indicated a difficult treatment might be involved. Samples were taken weekly from Prudhomme Lake for over a year. Based on analysis and coagulation tests run in our laboratory it appeared that the usual coagulation with the aid of clay and subsequent rapid sand filtration would give a satisfactory water supply. However, this item was deemed important enough to set up a small pilot plant at Prudhomme Lake. This was done in the spring of 1949 and the laboratory findings were confirmed.

It might be interesting to note that untreated water is used in the 600-pound boilers even though color as high as 80 ppm is encountered at certain times of the year. No foaming has been experienced.

Concrete aggregate in the Prince Rupert area in the quantities required was not available locally and the cost of shipping all the way up the coast of British Columbia was naturally not very attractive. There was a known deposit of fresh water, sand and gravel at Hastings Arm, 90 miles from the plant site which was being worked on a small scale by a Prince Rupert company to provide for the local needs. Except for this source, most fresh water aggregate was contaminated with organic matter—fish oil and scales—the aftermath of heavy salmon runs. This was discovered after receiving the analysis of many samples collected from the various stream beds within a radius of 50 miles of the plant. The Canadian National Railway indicated at one stage of discussions that they might be able to supply aggregate from a gravel deposit in the interior, but this did not materialize as they did not visualize the large quantity needed.

In view of these findings it was decided to stockpile aggregate from Hastings Arm in August 1948 so that there was approximately 15,000 yards on hand when work started the following spring. Continued investigations resulted in a discovery of suitable material at Porcher Island, 25 miles away. This was salt water material but our washing plant took care of this quite adequately. This proved to be a very valuable discovery for it is doubtful that it would have been possible to maintain continuity of operations at the height of the program in view of the long haul and heavy seas involved in the Hastings Arm run.

In working out the layout of the necessary railroad spurs it was discovered that the main track of the Canadian National Railway was centred within a 200-ft. right-of-way. Further, when this track was laid the rock excavation was carried through only for the western half of the right-of-way. This caused two problems: first, there was not enough room for company spurs to the east or plant side of the railroad between the main line and the edge of the rock cut; second, to get the main spur into the plant proper, the curve was too sharp. The Canadian National Railway agreed to move their main line 42 ft. to the west to alleviate both the above mentioned conditions and a curve of 12 deg. 30 min. leading into the plant site was established.

It was decided in July 1947 to start the rough excavation. There existed a small quarry which the army had blasted to get rock for roads on the island. Considering the elevations of tide and the existing railroad tracks, 18 ft. 0 in. was decided upon as grade elevation, based on mean tide as a datum. It

should be pointed out that at Watson Island the extreme tide difference is 25 feet giving an extreme high of 12.5 ft. Building floor levels were established at 18 feet 9 inches which gave a fall for sewers in the order of 6 ft. In order to get sufficient level ground for the plant and to hold costs down, a two level arrangement was agreed on and the elevation of 66 ft. was established for the upper level. This elevation was arrived at by the balance of cut and fill. In carrying out the excavation program all muskeg was stripped and hauled away to a dump along with mud from the lagoon, which was stripped prior to placing the excess rock fill from the lower level.

This work was a half million dollar contract and involved the removal of 412,000 yards of rock muskeg and mud. The work was completed June 1, 1948, the contractor using an average of about 75 men working on a two-shift basis most of the time. Under the best conditions 1,300 yards of rock and 700 yards of muskeg and mud were handled per day.

At this stage of the program it was decided to locate the boiler house on the upper level. A field study of the wind direction indicated the upper level would be on the leeward side of the plant away from any possible contamination from coal dust and smoke. It was also decided to put the wood room on this elevation in spite of the fact that this meant that the log haul would be very long and have to span the main line of the Canadian National Railway. The strip of land available for the construction of the wood room on the lower level on the west of the main line track was very narrow and was fill material. Knowledge of the fact that our chipper foundation supporting a 30-ton disc would have to be carried down to bed rock was a second factor influencing our decision.

In June of 1948 authority was granted by the management to proceed with the purchase of bulk material requirements for the building work. Commitments were made for Portland cement, reinforcing steel, form lumber, nails (a very important item at this time due to the general material shortages), roof flashing and structural steel. Further we were allowed to make commitments for long delivery equipment items such as boilers, turbo-generators, the main switchgear unit substations, and digesters.

Up until this time it was thought that the actual construction could start in September 1948, but here we ran into a major problem. A review of the building drawings indicated that they were not in sufficient detail and as a result construction forces could not be placed in the field until March 1, 1949. There was one minor exception to this in that it was decided to proceed with building our construction camp with local labor starting in October. This work consisted of three H-type dormitories, a dining hall complete with cooking facilities and a small administration building.

In view of the fact that we definitely knew that our construction drawings would come out on a piecemeal basis it was decided to build the mill with our own forces rather than using a general contractor. The company had previously completed two plants in Mexico and the general superintendent, carpenter superintendent and electrical superintendent were transferred to Prince Rupert for this project along with an office man and the writer. These key people were on site about Feb. 1, 1949.

The first work undertaken was a wood frame warehouse on our dock 44 ft. wide and 465 ft. long which was needed to handle the early shipments. A temporary railroad spur was laid into the mill area and the principal shops such as a carpenter's shop, truck repair shop, a riggers' shop and reinforcing shop were built. Further, we purchased and housed five 75kw diesel generator sets to supply construction power inasmuch as the local utility company was able to give us only 100 kw. The carpenter shop included a planing mill because rough lumber only could be obtained in the quantities desired. Plywood for forms was unavailable at this time and the form work was made up in panels in the carpenter shop before assembly in place. All reinforcing was purchased as straight rods and was cut and bent on the site.

It was agreed that construction equipment should be new and particularly suited to the work at hand because of the anticipated problem of getting sufficient highly skilled construction manpower. Some of the principal items purchased were a complete aggregate plant including screens, washer, crusher and sand classifier. The concrete mixing plant included a 28S mixer and the necessary weigh hoppers. Dump crete truck bodies were purchased and proved to be excellent because of their ability to completely discharge themselves in that they had rounded corners and could assume a vertical position. A Ross lumber carrier used to transport 2,000,000 board feet of form lumber from the storage piles at the north end of the island to the planing mill provided a most economical form of transportation.

We had available for construction certain equipment authorized for

Fig. 3. Concrete slabs for exterior of the plant were made in a special plant built at the mill site.

purchase for mill operations. In this category there was an ambulance, 5 fork lift trucks, a 45-ton diesel locomotive and all the machine shop equipment.

With the starting of the building of a field organization in February 1949, the field conditions were reviewed and a number of policies arrived at. In the first place it was obvious that union labor would predominate inasmuch as the unions whose laborers and carpenters had been employed on the construction camps had obtained certification as the bargaining agents by the first of the year. Further, Prince Rupert had only a handful of construction people as residents, it being primarily a fishing center. This meant that our construction crews would have to be drawn from the outside. Under these conditions it was established that we would agree to provide the same wages and working conditions as would have existed if a Vancouver building contractor had the work in hand and that we would ask for a fair day's work for a fair day's pay. We recognized the need of good supervision right down to the foreman level particularly because it was obvious that being away from the center of a strong labor market we could not expect to get as high a calibre worker on the average. We experienced considerable difficulty in obtaining these foremen and were never satisfied that we were strong enough in this respect. Many of the workmen had to be developed on the job. One of our outstanding groups in this respect were the reinforcing men.

It was decided to build our construction camp on Watson Island due to the fact that the only nearby facilities were at Port Edward, the adjacent cannery. The camp operation developed into a large size problem because of the need of checking all vehicles in and out of the camp to guard against theft. We would strongly recommend that where construction camps are required on such projects that they be located outside of the building area to eliminate the need of the necessary restrictions to assure protection of company property. The company hired an outside contractor to manage the construction camp at a fee based on the number of meals served. These people supplied the camp manager and an accountant. They hired all the camp help who were placed on Columbia Cellulose payroll and they requisitioned all food purchased on Columbia Cellulose orders. In this way, it was possible to eliminate any suspicions that the workers might have had that the caterer was profiting at their expense. Meals were served on a cafeteria set-up which made for greater variety and reduced waste. The operating costs under this set-up averaged 78c per meal which is proof in itself that the arrangement was a good one. The fee payment arrangement is to be recommended on this type of service.

Prince Rupert provided homes for many of the construction workers and it was necessary to provide transportation for these people. In the early stages of construction a local bus company was employed at a rate of 75 cents per man per day. This proved to be a difficult situation inasmuch as the small company was unable to give satisfactory service particularly in view of the old equipment they were attempting to use. The situation was aggravated by a road improvement program between the mill and Prince Rupert which resulted in very "rough conditions" at times. The outcome of this was that the company found it necessary to go into the transportation business themselves when the bus company insisted on an increased fare. To do this job nine 172-inch wheel base flat bed trucks were purchased which were equipped with covers and seats. These units with bodies eight feet by 15 feet accommodated 34 workers. Men with the proper driver's licences who were employed on the project were hired to drive these units and our round-trip transportation fare, allowing for a five year write-off period for the trucks, amounted to 22½ cents per round-trip. Further, these trucks were available for transporting material on the job during the day. Several were so constructed that the seats and covers could be removed with a small hoist after the truck was driven under an "A" frame. If we were starting over on this project we would naturally start on this basis. However, even though we knew of these economies, we were trying to encourage local business developments and had been assured that as this transportation item grew the bus company would reduce fares.

A significant item of cost on the project was the transportation of tradesmen to and from the job from their point of hire. Vancouver supplied literally hundreds of employees while others came from points as far away as Montreal. In view of the conditions as outlined above it was decided to hire a full-time personnel man who had a small staff of three people at the height of construction. A project of this type requires a qualified man for this work particularly in view of the fact that we had to write agreements for each and every trade union. Under the British Columbia Compensation Board regulations it is necessary to have a qualified first aid man on the site. The first man so hired was a "heavy weight" who headed up the first-aid group required to cover the various shifts. He also acted as safety man. The key people recognized the importance of the safety angle and co-operated fully. The company is very proud of the fact that there were no fatalities on the job and the accident frequency was low.

Because of our remoteness from headquarters and the scope of the work to be done, a field purchasing group was set up using the same controls as established for the parent company. The writer believes that this should be the practice on any major construction. This group purchased building equipment, materials, and supplies. All process equipment and all major building materials were purchased through our head office.

The last item of policy set-up at this stage was that there would be no changes in the design as supplied by our engineering office except as required for particularly good reasons. There is usually more than one way to do a job and some field people are inclined to change for the sake of changing. It was felt that our design people, having full knowledge of all the factors involved, were better equipped to make design decisions than the field organization whose proper function it was to execute the designs.

Excavation for the underground sewer and fire lines was included in our very earliest work. Our layout for these services provides for future building expansion so that if in the future additions are required this work will not have to be disturbed.

In connection with our process sewer, terra cotta was bought in bulk and shipped in early. We were able to purchase this up to 36-inch diameter. Forty-eight-inch and 54-inch diameter lines for the sewer outfall were made up of tile segments, concrete encased. Tile lined precast pipe was made on site. The tile segments were wired around a cylindrical form 6 ft. long, outside of this was placed a hinged circular form and in the annular space between the tile an outside wooden form was placed reinforcing mesh

and high early strength concrete. The joints between the tile segments were made up with alkor cement and when the sections were assembled the same material was used. In order to take up the irregularities in the sewer trenches, a thin slab was poured at the bottom of the trench. The 48-inch diameter, 6-foot long sections thus cast cost $100 each—$40 labor and $60 material. If this work were to be done over, I believe that a rectangular wood stave construction would prove to be less costly.

The waterline was started in February 1949 on two fronts—one, tunnel work, and the other the preparation of grade for the wood stave pipe. There were three tunnels involved, two about 2,200 ft. long and a third, on Watson Island itself, about 500 ft. long. The wood stave pipe 29,000 ft. long was over land except for a tresseled portion between Watson Island and the main land a distance of 1,400 ft. The terrain traversed by the water line was extremely rough involving steep side hills, rugged cross country work and long stretches of muskeg. A great deal of blasting and heavy fill work was involved.

The building phase of the program carried on for approximately one year from the middle of 1949 to the middle of 1950. By July 1949 the organization had begun to take shape and it was decided to spread our forces over the job rather than centering on the office and pulp storage building at the east end of the lower level. Therefore, work was started on the wood room at the west side of the upper level, at the powerhouse on the east end of the upper level, and at the digester building on the west side of the lower level. In this fashion the men worked at greater efficiency and there was built up a degree of pride amongst the various groups based on the area in which they were working. Our design called for large chests throughout the main part of our process building on the lower level and the initial designers concluded that these high chest walls should perform a dual function, that is building walls as well as chest walls. This meant that the erection of the steel work was held up until these walls were complete, which took a fair amount of time because of the complicated form work. In light of this, I doubt if we would repeat this procedure again.

For our concrete work it was decided to use Darex, an air entraining agent. The main reason for this was to get a more plastic concrete that would flow into the forms and around the steel without segregation or bleeding. Further, with the attendant reduction in water used the concrete could be finished sooner. This material does not eliminate the need of the proper vibration and careful placement of concrete but is an aid in this work. The entire project involved the pouring of 55,000 yards of concrete. During the peak of the building program, pouring was at the rate of 200 yards per day.

Dominion Bridge fabricated and erected the bulk of the structural steel on the project. The job is unusual in that the steel was available before the completion of the first footings. This resulted from the fact that a bulk order was placed early and we had the delay at the end of 1948 previously mentioned. This condition did not last very long however and once the operation was spread out over the project the steel erection and concrete foundation work progressed well on all fronts. There were 4,600 tons of structural steel involved, exclusive of the miscellaneous platforms, stairways and supports.

As has been previously publicized our digesters were assembled and welded on site. This work was also performed by Dominion Bridge and the need for co-ordination of the structural steel erection in with the digester steel was one of the major factors in awarding the order for the digesters.

Early in the planning of the overall building construction two conditions were set up as regards the walls. First, for the main process areas, they had to be tight, and secondly, in the process areas where there were high humidities, insulation was deemed necessary to prevent contamination of the product from condensate. It was discovered that in all British Columbia there were only between two and three hundred bricklayers and further the brick that was available would require a long freight haul. Another factor in the matter of wall erection was the fact that we were faced with a heavy rainfall that would preclude working on many of the days. Reinforced concrete walls were considered but the buildings were so high that placement costs ruled this out. In view of all these angles it was decided to investigate and finally go ahead with the work using precast concrete wall panels 6 ft. by 10 ft. in size (Fig. 3).

Insulated panels 5½ inches thick over-all with 2 inches of foam glass incorporated were used in the high humidity areas. Solid 4-inch thick panels were used in the areas that required tight walls but did not have humidity problems and Trafford tile sheets were used for the wood room and chip storage building, as these latter two buildings did not require tight walls. The insulated wall panels cost $2.10 per sq. ft. erected, while the uninsulated solid slabs cost $1.27½ per sq. ft. erected.

As has been previously mentioned we deemed this program a success but certain changes were indicated as desirable for future jobs. These modifications are being used in connection with the construction of

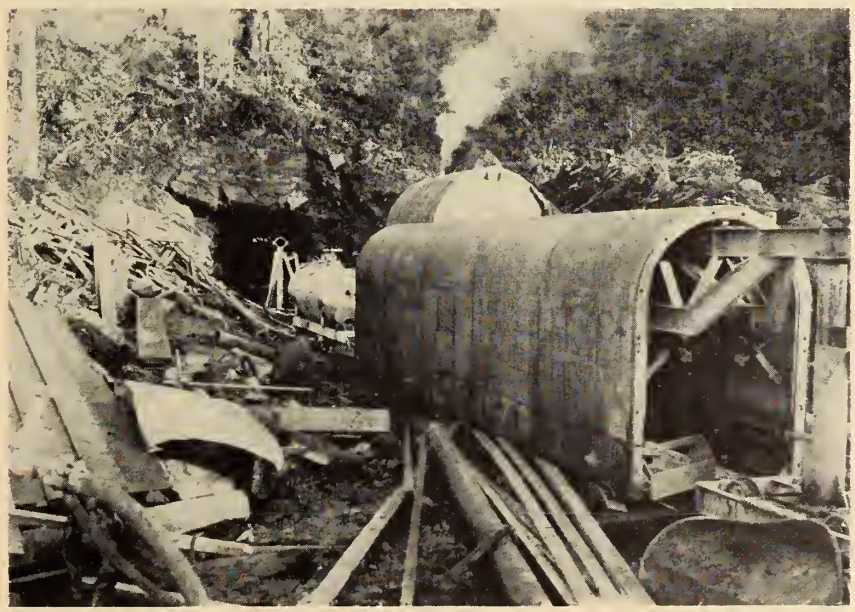

Fig. 4. Forms, 25 feet long, were moved into place in the tunnel on a dolly mounted on narrow gauge railway wheels.

the Canadian Chemical Company plant at Edmonton now in progress. On this job the panels will be supported by the building steel rather than from the foundation, and there is more uniformity which will result in fewer sizes required for special conditions.

The casting of the panels was by Creaghan & Archibald, erection was by Columbia Cellulose personnel. We feel that the decision to use the precast wall panels on this job was a proper one because along with the relatively low costs for first class wall construction we obtained the additional important advantage of speed of erection in spite of the prevalent wet weather. In the case of the digester building, the precast roof slabs and precast walls on the south and west elevations were erected 12 days after the building steel was riveted. This provided enough shelter for the digester welding program to get a quick start. Details of the methods for the Columbia Cellulose and several subsequent jobs have been published.

The roofs were flat precast channel shaped slabs. These varied in length from 6½ ft. to 10 ft. and were 16 in. wide. Creaghan & Archibald produced these on the site and they were erected by the construction forces at a cost of 3.2 cents per sq. ft. When it came to roof insulation it was decided to use foam glass. One of the prime considerations here was the fact that we knew any insulation material would be subjected to exposure to winds and rain. This type of insulation when it got wet proved simple to dry and as a consequence there were no costly delays in placing the insulation. The application of the roofing was a long drawn out program because of the unusually high rainfall. The contractor's workmen often worked overtime making the most of the relatively few dry periods.

The construction of the tunnel linings was interesting. As previously mentioned, there was approximately one mile of tunnel work. The tunnel was horse-shoe in shape, 5 ft. wide by 7 ft. high which was reduced by a 6-inch thick concrete lining to 4 ft. wide by 6 ft. high. For the most part in the driving of the tunnels the work proceeded from two faces on a two 8- to 10-hour shift basis. There was a break of at least two hours between shifts for clearing out smoke and pumping in fresh air. A crew (three miners and three laborers) would start by mucking. Following this came the necessary drilling, charging and blasting. In this fashion, each shift advanced 5 ft. The drilling pattern called for 19 holes, but even with this there was considerable overbreak. Air powered mucking machines loaded into mine cars which were drawn by electric trammers to the dumps. For the lining work, curbs and floors were first poured. Next, collapsible forms 25 ft. long were moved into place on a dolly which was mounted on narrow gauge railway wheels (Fig. 4). There were four such forms on the job. Pouring of the concrete lining was continuous on three 8-hour shifts. On this basis, pouring at the rate of 75 ft. per day, the long tunnels took about 30 days. The concrete was mixed in two 16S mixers at the tunnel portals, it was then discharged into one of the custom built, one cubic yard, placing machines from which it was forced by air at about 100 lb. pressure through a 6-inch rubber hose connected to a 6-inch steel slick pipe which was placed at the top on the near end of the form. The balance of the open space at the edge of the form was bulkheaded with wood. The contractor used two concrete placing machines and two 315 c.f.m. compressors for this work. The main portion of the tunnel was not reinforced. About three-quarters of a cubic yard of concrete per lineal foot was required although one-half yard was the theoretical figure, overbreak accounting for the extra material. Tunnel drilling costs and concrete lining costs were about equal at $45 per lineal foot. Preparation of the pipe line grade ran about $17 per lineal foot and placing of the wood stave pipe approximately $7 per lineal foot. The wood stave including the bands, sills and cradles were purchased by Columbia Cellulose at a cost of $13 per lineal foot.

During this building phase the manpower on the project averaged 900 men with about 700 of these on Columbia Cellulose payroll. The Christmas holidays and extremely cold weather during the first six weeks of the year brought this average down considerably. Progress during this period was limited to roofing, structural steel erection and form work. Practically no concrete was poured because of the lack of water. Our construction water supply was from a system serving Port Edward. The 14-inch wood stave main froze solid. Electric power was curtailed in Prince Rupert because the freeze up reduced their water supply and as a result we had to go to a 6-hour shift starting at 10 a.m.

We went into the equipment phase of the project about the middle of 1951 with a total working crew of 1,250. This was the most difficult period due to the shortage of skilled workmen, shortages of critical electrical and piping materials and the usual problems associ-

(*Continued on page 1057*)

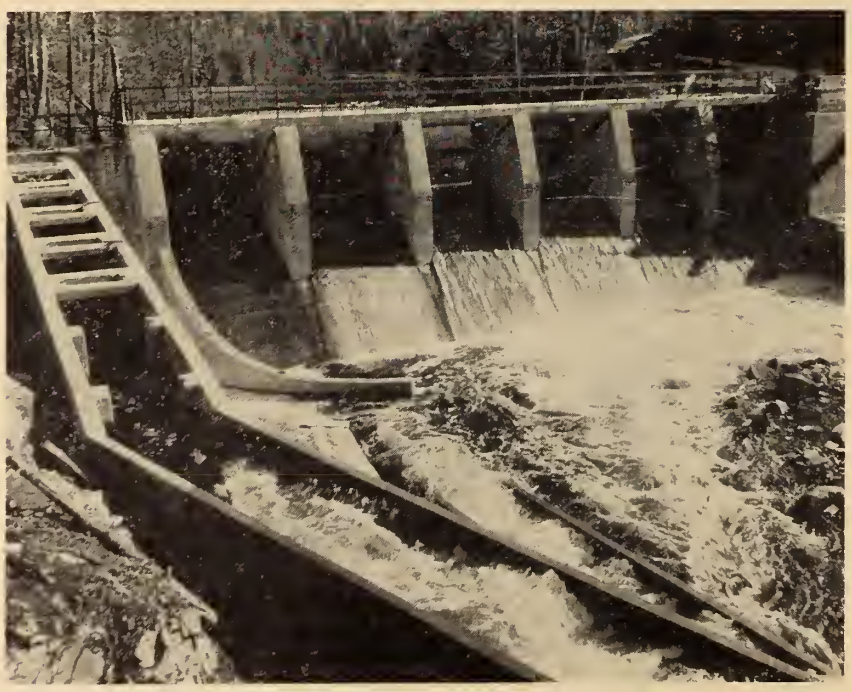

Fig. 5. This dam on the Kloiyah River regulates the flow of water to the pulp mill. Built into the dam is an ingenious fish ladder which enables salmon to swim upstream to their spawning grounds.

Iron Ore Development in Quebec and Labrador

by

W. H. Durrell

Iron Ore Company of Canada, Montreal.

A paper presented to the Hamilton Branch of The Engineering Institute of Canada, January 17, 1952.

The concession area held by the Iron Ore Company of Canada for mining the Quebec-Labrador iron ore deposits is approximately equivalent to a strip a mile wide around the earth at the Equator. The author describes the 360-mile railroad and the airlift, one of the largest ever organized, needed to develop this vast area. He points out that without U.S. Capital the project could not be carried out. He says Canadians offered to invest only $2,000,000 of the $100,000,000 needed in addition to the $100,000,000 investment of the controlling partners, Hollinger Consolidated Gold Mines Ltd., and The M. A. Hanna Co.

The relatively short history of iron ore discovery and development in Eastern Quebec and Labrador goes back to 1929. The first ore was discovered in Labrador at that time, and a concession for its development was acquired in 1936. By 1939 it was evident that what was long known as New Quebec also held deposits of iron ore and a license was obtained covering 3,900 square miles. The next three years provided the stiffest testing period for the far-visioned men who were convinced that here lay natural wealth which could become of infinite value to the economy of Canada. Financing the preliminary exploration of the ore deposits within the Quebec and Labrador concessions was a problem. Finally, in 1942, Hollinger Consolidated Gold Mines Limited entered the picture and, the same year, The M. A. Hanna Company became associated with Hollinger as a partner in the venture.

Following the preliminary financing, work was confined for some years to geological mapping and prospecting as well as to extensive drilling to outline the ore deposits. Intensive drilling did not commence until late 1947. Two years later, the Iron Ore Company of Canada was formed for the purpose of further financing the development; and, in this new organization, five American Steel Companies—Republic Steel Corporation, National Steel Corporation, Armco Steel Corporation, Wheeling Steel Corporation, and The Youngstown Sheet and Tube Company—joined with Hollinger-Hanna and the concession companies with the definite view of preparing for commercial production.

Some idea of the magnitude of the venture can be gained from the fact that the concession area is almost equivalent to a strip a mile wide around the earth at the equator. The importance of the iron ore area may be judged by some comparison with the famed Mesabi range in the United States. On the Mesabi, the area of favourable rock is 110 miles long and from one to five miles wide, with a productive zone of about 70 miles in length. On the Labrador-Quebec concessions, the area of favourable rock, situated in what is known as the Labrador Trough, is 225 miles long and from ten to 60 miles wide. Already exploration has disclosed a productive zone 90 miles long, with chances of extension at both ends.

More than 400,000,000 long tons of direct shipping, open-pit ore, of excellent quality have been developed. Two-thirds of this is in Quebec, and the remaining third in Labrador. Some 53,000,000 tons will grade 50 per cent iron and eight per cent manganese. There is, in addition, a large tonnage of marginal material from which silica can be cheaply removed by washing; and, in the south-west portion of the Labrador concession there are very large unmeasured reserves of concentrating ore for the more remote future. Two hundred million tons are within a radius of a mile or two of the base camp at Knob Lake, which is 360 miles north of Seven Islands on the Gulf of St. Lawrence. This is a deep-water port capable of accommodating large ocean-going freighters.

At the moment, activities are concentrated upon construction of the railroad, which is of standard construction using 132 pound main track rail, the largest presently used in Canada. It will have treated track ties, 14 inch tie plates, six hole joint bars, and No. 12 passing track turnouts. The track will be ballasted initially with local gravel, and when the road bed becomes stabilized the main track will be rock ballasted throughout.

Ore cars will be the solid box welded type with a capacity of 95 tons, equipped with roller bearings. These will be larger than any ore car presently in use in Canada, and the railway will be the first to adopt complete roller bearing application to freight car equipment. Instead of the 33″ wheels generally used, the cars will have 36″ steel wheels to produce a better distribution of

Fig. 1. At Seven Islands on the North Shore of the St. Lawrence River, an ore loading dock (lower left) is being constructed. At centre is a temporary dock and in the distance a ship unloads at the government dock. The port is free of ice for at least nine months of the year.

weight per inch of wheel circumference. They will have empty and load clasp brakes and semi-tight lock couplers. Cabooses will be of all-steel construction, equipped with roller bearings.

The motive power will be 1,500 hp. diesel road switcher type. This particular type has been selected as it is a satisfactory power unit in both road haul and yard switching operations. Road locomotives and units in yard work at the mine can be interchanged, thereby centralizing maintenance in the main locomotive and car shop at Seven Islands.

The railway is 360 miles long (the same distance as from Oakville to Montreal). For operating purposes there will be two subdivisions of 180 miles. Train movements will be by signal indication, commonly known as C.T.C., supplemented by end to end radio communications. Passing sidings will have powered, remote controlled switches at the south end and spring switches at the north end. Loaded trains will be kept on the main track at meeting points. Motive power and cabooses will operate through between Seven Islands and the mines (Knob Lake). Crews, both train and enginemen, will change off at Midway, the intermediate terminal, where suitable bunk house and feeding accommodations will be provided. Loaded trains will consist of 115 cars, 14,000 trailing tons hauled by four locomotives, totalling 6,000 hp. Tentative running times are 14 hours for loaded trains and 12 hours for empty trains. To handle the tonnage output of 10,000,000 tons in the operating season, approximately seven trains must operate in each direction per day. The operation will require 55 diesel units, 20 cabooses, 2,400 ore cars. For construction and future maintenance there will be 175 ballast cars, 50 boarding cars, 20 air dump cars, 100 flat cars, 15 tank cars and 20 box cars. There will also be two 250-ton wrecking cranes with the accompanying wrecking equipment.

The two main terminals will be Knob Lake and Seven Islands. At Knob Lake there will be a common yard for receiving empty trains and despatching loaded trains. Several spurs will extend from this yard to the mine pits. Yard operations will consist of transfer of empty cars to the loading chutes at the pits and return of loads to the main yard, to be made up in trains of approximately 115 cars.

At Seven Islands the yard will consist of a receiving yard, classification yard, departure yard, stock pile yard, car repair yard, locomotive servicing tracks and locomotive shop and car shop, with more than 40 miles of track.

Loaded trains are directed into the receiving yard by signal indication and remote control switches. When the train is part way into the yard, the caboose is detached and runs by gravity towards the departure yard, finally entering upon the caboose tracks which have a slight incline grade. Thus it can be dropped eventually by gravity to the rear of an empty train for departure, eliminating any switch engine handling of cabooses. As they are pooled, it is immaterial which one is used.

In the receiving yard the trains are passed over a hump into the classification yard where different grades of ore are segregated. As the cars pass over the hump they are automatically weighed and are inspected from an inspection pit. The inspector can brand any cars requiring repairs by the simple operation of a hand lever. From the classification yard, cars are moved by between-track side-pusher engines to a car dumper which is designed to handle two cars at once. It turns the cars over and ore passes through a further crushing process to a conveyor belt which feeds to ship or stock pile. The empty cars leave the dumper down an incline which gives them sufficient momentum to carry them to the various tracks in the departure yard.

Those branded for repairs are directed to the repair yard by a man

in a tower who also operates the car retarders. The car marker at the inspection pit marks the car so it is plainly visible to the operator in the tower.

The entire railway, including terminal facilities, is designed for future expansion based upon handling 20,000,000 tons per season. This would require installation of a second car dumper and some yard additions. The main line would require practically no alteration as the initial 22 passing sidings, together with the signal system, gives a potential capacity of 42 trains per day and practical capacity of 36 trains per day.

Approximately 140 miles of the right of way have been cleared and more than 35 per cent of the total grading has been completed. The laying of steel has begun along the southern part of the road. A 2,250-ft. tunnel was completed last August and work is continuing on a 700-ft. bridge at the north portal of the tunnel. At Seven Islands, construction on the terminal has begun. The freight yard is cleared; administrative offices and warehouses have been erected; and work is under way on loading docks. Two power projects have been commenced, one at each end of the railroad, and operations at both points are on schedule. A housing program for employees was started recently.

To keep construction work on schedule, Hollinger Ungava Transport, a subsidiary company, operates one of the largest civilian airlifts the world has ever seen. Last year this airlift carried 33 million lbs. of supplies and 22 thousand passengers. Some pieces of equipment transported weighed as much as fifty tons and had to be shipped knocked-down and re-assembled on the job. It was necessary to cut some equipment with torches and re-weld it upon arrival at its destination. Twelve airplanes and two helicopters work round the clock. Ten airstrips have been constructed at points between Seven Islands and Knob Lake. The flying record for 1951 will be surpassed in 1952 and 1953 as the railroad pushes inland from Seven Islands.

Plans call for the ultimate delivery of from 60,000 to 70,000 long tons of ore per day to Seven Islands during a five to six months' season to bring annual shipments up to 10,000,000 tons. Ships will be loaded at the rate of from 6,000 to 7,000 tons per hour.

The Seven Islands port is free of ice for at least nine months of the year. Some 2,000,000 tons of ore will be stock-piled at dock side to extend the shipping season each year. Actual mining will be undertaken during six months; suspension will be necessary in the depth of winter because the ore would freeze in the cars between the mines and the port.

The Iron Ore Co. plans to spend, in all, more than $200,000,000. The railway will cost about $75,000,000; rolling stock and other requirements, another $50,000,000; harbour facilities and ore docks at Seven Islands will require about $15,000,000. The balance will be spent on power developments, townsites, mining equipment, etc.

To ensure a fair return on this investment, a minimum of 10,000,000 tons of ore must be mined and shipped each year. It is hoped that production will be increased eventually to 20,000,000 tons a year.

The possibilities of discovering even more iron ore have not been exhausted. In the past 12 months, three new deposits of high grade ore have been uncovered and, in each open season for many years to come, it is planned to continue exploration and proving of the further deposits believed to exist.

The United States, and later Britain and Western Europe, will be the markets until such time as Canada has sufficient population to be able to absorb at least a substantial volume of the production.

It may be disappointing to some Canadians that this country is still unable to utilize all of the natural wealth it possesses. Canada's nickel, asbestos, paper, wheat and other agricultural products become profitable only through exports. While some may regret this situation, it cannot be overlooked that other countries export natural resources to Canada and thus contribute in-

Fig. 2. A crane lays track in a cut near Mile 12 of the 360-mile railway being constructed from Seven Islands to Knob Lake. The rail is 132-pound, the largest presently used in Canada. Loaded trains will consist of 115 cars, 14,000 trailing tons hauled by four diesel locomotives, totalling 6,000 hp.

Fig. 3. Rock drilling at the power house site at Marguerite Dam. The whole project, including railway, power dams, airlift and exploration, employs 4,000 people.

valuably to her economy. For example, the great aluminum industry of Canada could never exist if British Guiana were to refuse to export the millions of tons of bauxite used in the Canadian smelters. Every ounce of bauxite converted into aluminum in Canada must be imported because there are no bauxite deposits in this country. Nevertheless, many Canadians would be more satisfied if Canada were able to process more of her natural welath.

It is all a question of population. So far as Quebec-Labrador iron ore is concerned, the day that Canada is able to count 30,000,000 people within her borders, she will be able to depend upon a large proportion of her production remaining at home. At the same time, I do not wish to create any impression that the Iron Ore Co. is crossing Canada off the map. On the contrary, the company proposes to set aside large reserves of the iron ore for use by Canada when Canada needs it, and the company will look forward to the day when it can supply steel mills in Hamilton with their requirements. The company is also collaborating with Laval University in Quebec City and the Mines Department of the Province of Quebec in research directed toward a successful method for use of iron ore in that province.

If any financial interests wish to erect steel mills in Canada which can be served economically from Iron Ore Co. mines, or if the existing plants wish to expand, the company will be only too happy to ensure them a constant stream of high grade iron ore.

Meanwhile, the company is pushing ahead as quickly as possible so as to be able to serve the markets which are open to it. There is virtually no Canadian market at the present time. In 1951, Canadian steel mills consumed 4,900,000 long tons of iron ore. Four million seven hundred thousand long tons were produced by Canadian mines. That left a deficit of a mere 200,000 tons a year. On the other hand, American consumption is more than 100,000,000 tons. It is apparent, therefore, that the United States is the best market at this time. But I would like to emphasize that the Iron Ore Co. still faces stiff competition from overseas ore-producing nations such as Sweden, Liberia, Brazil and Venezuela. The combined reserves of those exporting countries are colossal, and production costs in some of them are pretty low. The Iron Ore Co. does, however, enjoy one advantage over all of them when the Canadian and United States steel markets are considered. Overseas nations can supply North American steel mills in times of peace. But, during war periods, the Iron Ore Co. alone would be in a position to guarantee delivery of the huge quantities of iron ore required.

The company is financing every cent of the more than $200,000,000 to be spent on the project. It is building a railroad without one cent of public subsidy and without one acre of the land grants which, for so long, accompanied railroad construction. It has built 200 miles of service roads without one cent of assistance from the public treasury.

There are some people who seem to believe the Iron Ore Co. has been

Fig. 4. Hollinger Ungava Transport, a subsidiary of the Iron Ore Company of Canada, operates one of the largest airlifts ever organized. Last year this airlift carried 33,000,000 lbs. of supplies and 22,000 passengers. In this photo a DC-3 is being unloaded at the Mile 35 airstrip.

handed a gigantic iron mine on a silver platter. That is not so. The company pays all of the mining taxes levied upon other mining corporations in the Province of Quebec and, in addition, it will pay an annual rental of 50 cents an acre upon the 300 square miles which will constitute its ultimate concession when exploration has been completed. That annual rental means the company contributes $100,000 a year to the Quebec Treasury, in addition to all standard mining taxes.

The entire development is a monument to Canadian and American business co-operation. To those who criticize what is called the excessive penetration of American finance into Canadian affairs, I say that this could never have been an all-Canadian proposition. The principal reason is that the Iron Ore Co. could not undertake this venture without assuring itself customers for its ore. The most logical way to ensure a market was to induce American steel companies to participate as partners in the venture.

At one stage in the proceedings, Canadians could have played a much larger part than they did. In addition to the $100,000,000 subscribed for by the partners, a further $100,000,000 was required. The first step was to try to interest Canadian financial institutions in the type of investment best suited to the enterprise. All that could be obtained from Canada was $2,000,000. Therefore, an appeal had to be made to American businessmen who were willing to risk their capital in the hope of building a long-term, fair-return investment. It must be regretted that Canadians were not more interested in the development of these huge iron ore deposits. But their hesitancy, perhaps, caused little surprise. We, who are born in this country, seem to be traditionally over-cautious. How many of our natural resources to-day are being profitably developed only because Americans were willing to gamble when Canadians hesitated?

Because a lot of American money is being sunk in this Canadian iron ore development, do not imagine that Canada is getting the short end of the deal. On the payroll of the Iron Ore Co. are some 4,000 people. They include geologists, engineers, and a wide range of technical specialists. Of the 4,000 working on the iron ore development, there is just one American, a specialist in large-scale, open-pit mining. The company's preference for things Canadian also extends to materials. So far, it has spent $50,000,000 in supplies and 98 per cent of that sum has been spent inside Canada.

Once the Quebec-Labrador iron ore mines start producing at the annual rate of 10,000,000 tons, they will earn 90,000,000 American dollars a year, a large proportion of which will come north of the border to stay. These earnings will strengthen still further the value of the Canadian dollar in the markets of the world.

Some Canadians may consider the discovery and development of these huge iron ore deposits as extraordinary. I do not. During the past 30 years my work has been mostly in northern Canada from Newfoundland to British Columbia and including the North West Territories. From first-hand knowledge, I can say that only a very small fraction of our northland wealth has been scratched and that new mines will be found for many years to come. My hope is that, in the development of the immense wealth still lying idle, Canadian capital and Canadians will play a full part and, like the men who are bringing the Quebec-Labrador iron ore fields to fruition, they will take an appropriate part in the building of the greater Canada which lies ahead. √

PLANNING AND CONSTRUCTION OF THE COLUMBIA CELLULOSE MILL

(*Continued from page 1052*)

ated with the start-up. It was necessary for our personnel manager to make four or five trips across Canada from Vancouver to Montreal recruiting tradesmen. Further, it was necessary to substitute for many of the electrical material items and a group of expeditors were scattered throughout Canada to work with the vendors aiding them in obtaining materials from their sub-vendors and directing shipments by express and air as required. The equipment in the main was essentially the same as one would find in any modern pulp mill with exceptions such as the bark burning equipment, welded digesters and special bleach refining.

A solid concrete gravity dam was built by the Company forces during this period, it is 234 ft. long with a spillway section 91 ft. 6 in. long. The height at the spillway section is 19 ft. high, the balance is 29 ft. high. The storage area formed is 600 acres. Stop logs provide for variation in storage level.

The Kloiyah River water system involved is frequented by salmon and therefore provisions were made to take care of both the adult fish and the fry. A fish ladder (Fig. 5) was incorporated in the design requiring 6 c.f.s. It is 214 ft. long with a 5-foot clear inside width. Because of the steep river banks it was necessary to have the fish ladder double back on itself and discharge just below the spillway. A wing wall was required to protect the mouth of the fish ladder from the spillway current as the fish will not travel with the current. There are nineteen 8-foot long pools in the fish ladder, separated by baffles which provide an 8 in. by 8 in. hole at the bottom for fish passage in addition to the path over the crest of the weirs. The drop through the fish ladder is 16 ft.

In the intake system there is an adjustable skimmer pipe with a bypass channel to the stream below to handle the fry that work their way down stream in the spring. They usually travel near the water surface. There is a second provision for bypassing the fry at the wash trough of the travelling screens at the intake.

The bark burning equipment has proved a complete success. Our boilers are producing approximately 300,000 lb. of steam per hour. With coal costing $9.72 per ton in the bunkers we have realized a considerable saving in fuel. Numerous runs on the bark indicated moisture after passing through the squeeze rolls was down to 45 per cent and had a B.t.u. value of 4,800 per lb. as fired. On this basis, 2½ tons of bark would be equivalent in heat value to one ton of coal. Present estimates from the mill (which appear high) state 26 tons per hour of wood refuse will be available at the future production rate of 300 tons per day. On an 80-hour week this would give 2,080 tons of refuse per week which, when converted to a coal basis, would provide the equivalent of 830 tons of coal valued at $8,100. This, of course, presumes top conditions. There is a further marked advantage in that we can take care of the bark refuse disposal at the same time. √

Generation and Transmission of Power Developed on the St. Maurice River

by

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A paper presented at a joint meeting of The Engineering Institute of Canada and the American Institute of Electrical Engineers, in Montreal, January 28, 1952.

The St. Maurice River supplies most of the power required by the Shawinigan Water and Power Company. The generation and transmission of this power is discussed here from the viewpoint of the system design rather than equipment design. Considerable attention is given to switching arrangements and types of equipment. There is also a section on methods of regulating system voltage and the application of shunt capacitors. The author mentions methods of relay and lightning protection and the types of transformers used in the system which has more than 10,000 miles of transmission and distribution circuits.

Introduction

The Shawinigan Water and Power Company was incorporated in 1898 and serves a territory of more than 20,000 square miles. The peak load during 1952 exceeded 1,300,000 kilowatts, requiring 8.0 billion kilowatt-hours of energy. The capacity of the interconnected 60-cycle system, which includes the St. Lawrence, St. Maurice and Saguenay Systems, will exceed 4,000,000 kilowatts during 1953. The Shawinigan Water and Power Company transmission network forms the tie between these three major hydro-electric power systems.

The Power System

The St. Maurice River is controlled by means of regulating dams and storage reservoirs. Many of the regulating dams are located at the generating stations. Gouin, which was completed in 1917, is the largest storage reservoir on the St. Maurice River, with a storage capacity of

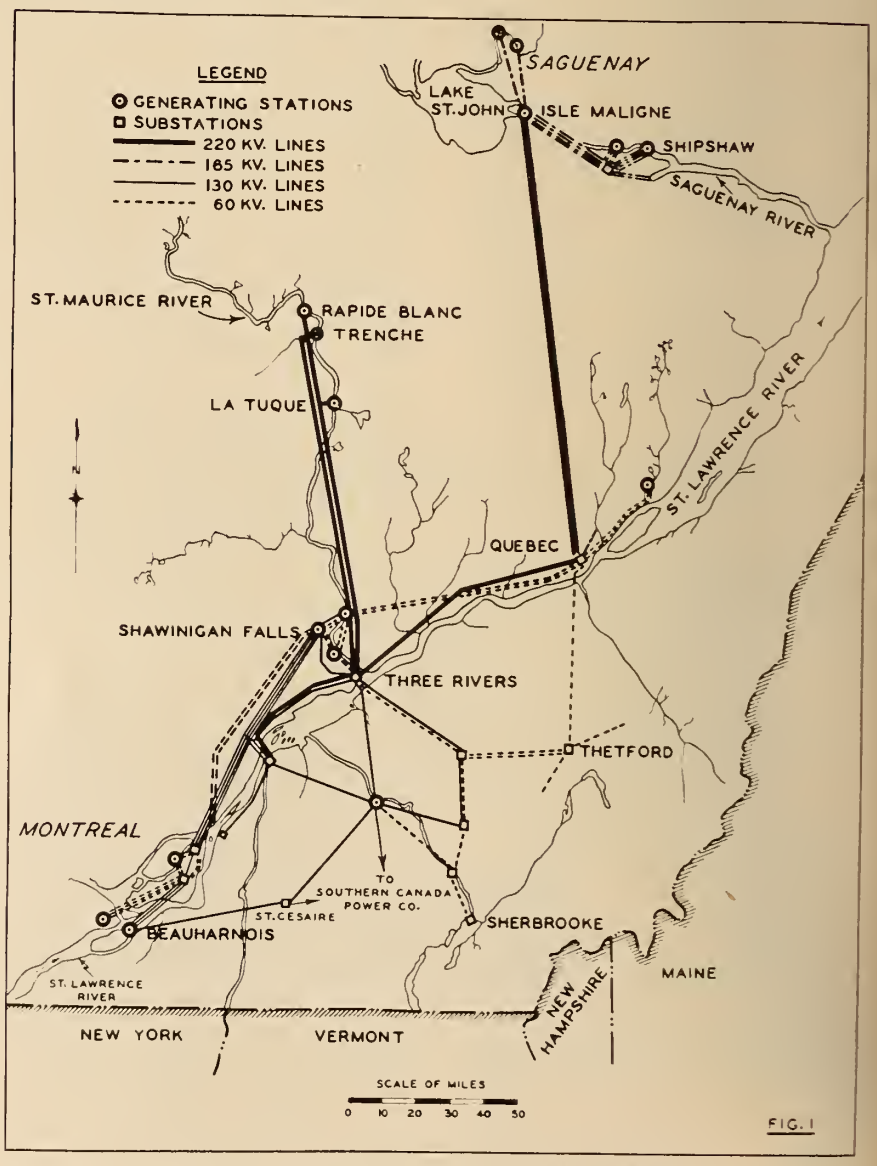

Fig. 1. The High Voltage Transmission System.

Fig. 2. 65,000 hp. Generators, Trenche Generating Station.

Fig. 3. The Double Circuit 130 kv. St. Lawrence River Crossing at Trois Rivières.

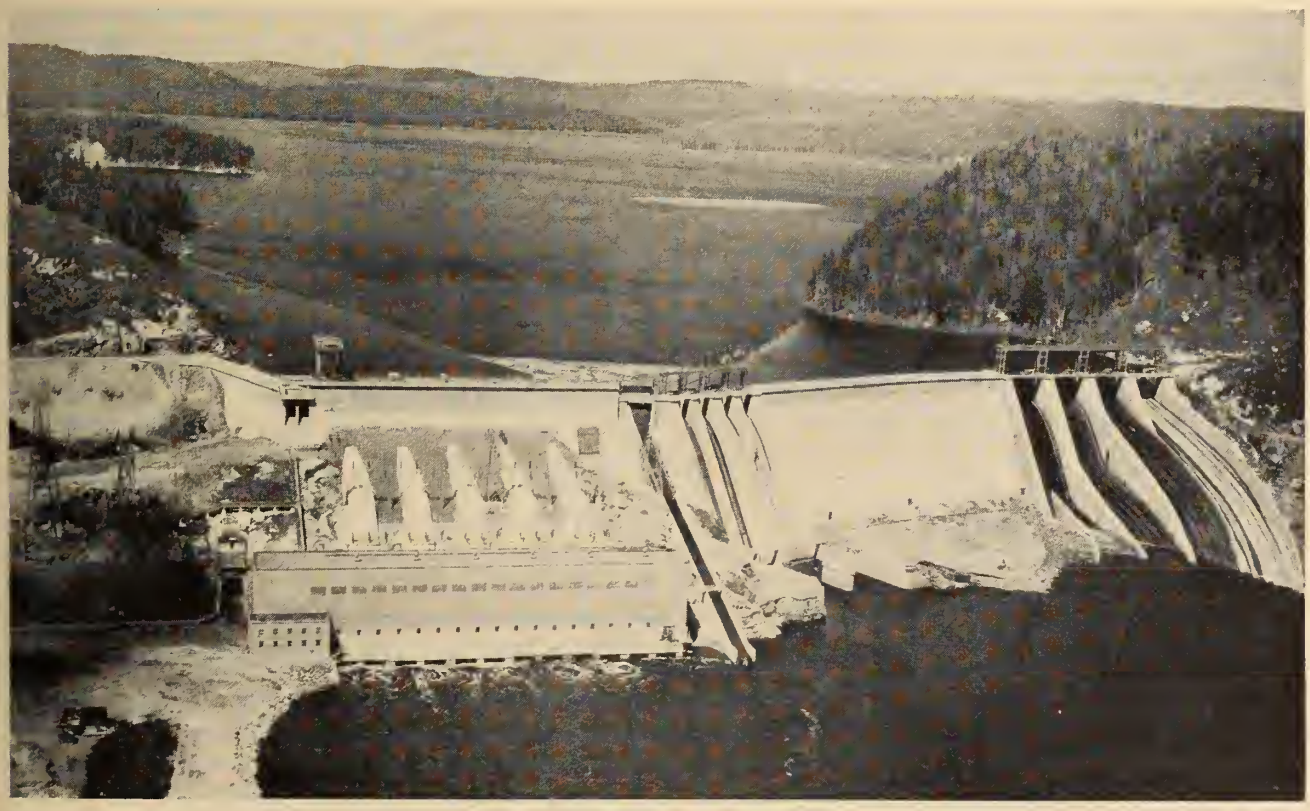

Fig. 4. Trenche Generating Station, installed capacity 325,000 hp.

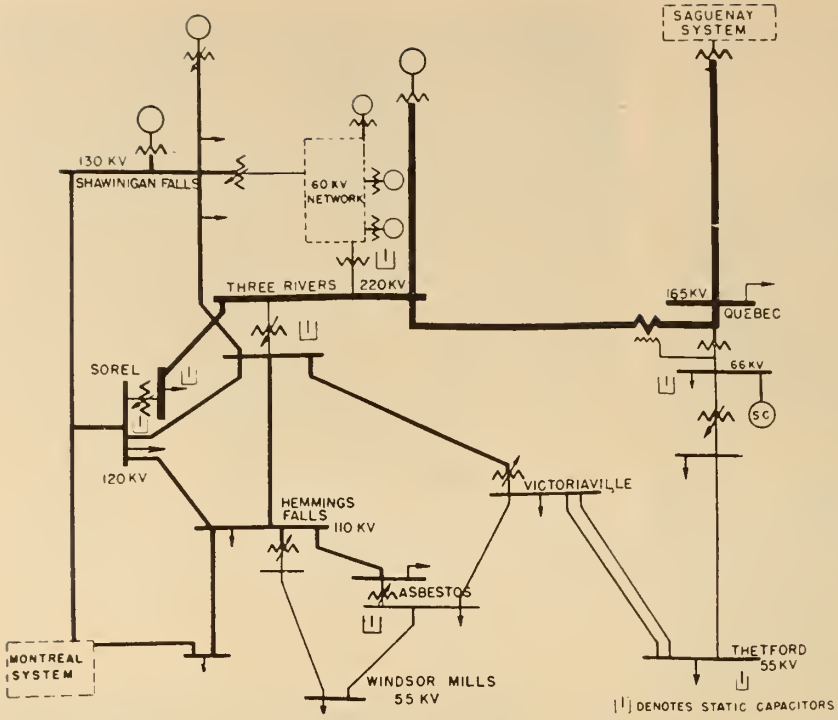

Fig. 5. Voltage Control Diagram.

275 billion cubic feet. The flow of the river is regulated at 20,000 cubic foot seconds and the total capacity of the various storage reservoirs and dams, including Gouin, is in the vicinity of 375 billion cubic feet.

Generating stations have been developed in two main areas: the lower St. Maurice and the upper St. Maurice. The lower St. Maurice developments include Generating Stations Nos. 2 and 3 at Shawinigan Falls, as well as the Grand'Mere and La Gabelle stations, with a total installed capacity of 600,000 kw. The upper St. Maurice developments include generating stations at Rapide Blanc and Trenche, as well as the St. Maurice Power Corporation generating station at La Tuque, with a total installed capacity of 550,000 kw. The total installed capacity on the St. Maurice River is 1,150,000 kw., producing an annual energy output of 6.5 billion kwh. There are a number of undeveloped sites and provision has been made for installing additional units in existing stations. These additional installations have a potential output in excess of 600,000 kw. The ultimate capacity of the St. Maurice River is of the order of 1,750,000 kw. and 9.0 billion kwh. of energy.

Most of the St. Maurice River power is either developed in or transmitted to the Shawinigan-Trois Rivières area for distribution to load centers. The high voltage transmission network may be divided into the North Shore and the South Shore systems. These two main systems are interconnected by St. Lawrence River crossings at Sorel, Trois Rivières and Quebec, comprising a total of six circuits. There are in service more than 10,000 miles of transmission and distribution circuits of which 20 per cent operate at 60 kv. and above. Major terminal stations are located at Montreal, Sorel, Trois Rivières and Quebec. These terminal stations are used as distribution points for the main power supply. This also applies to high voltage switching facilities at generating stations and load centres.

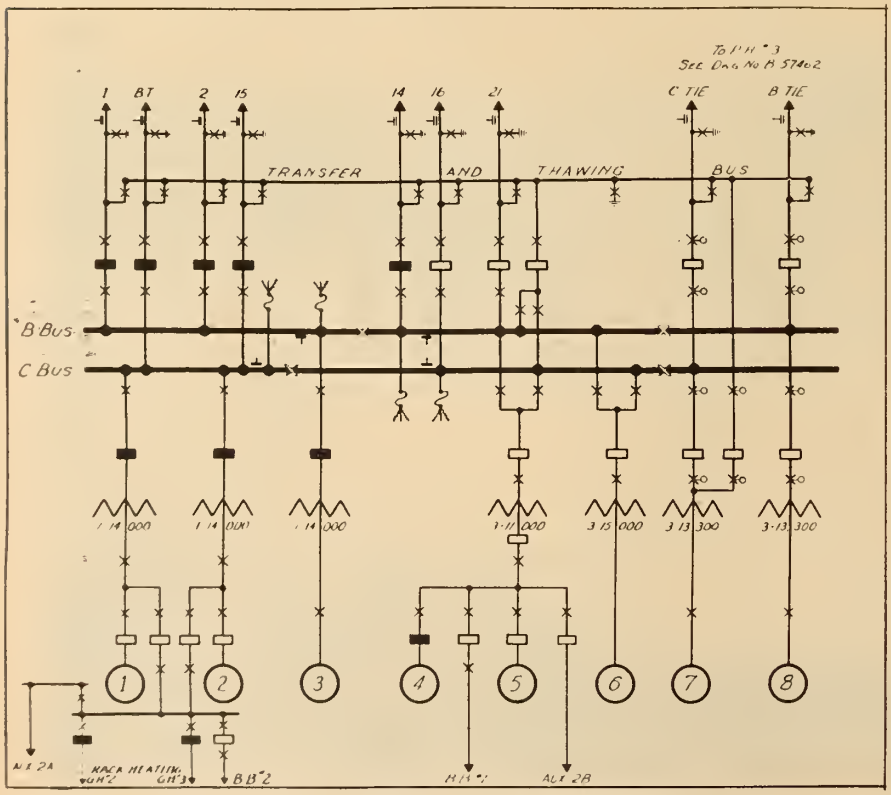

Fig. 6. Generating Station No. 2—Shawinigan Falls.

Voltage Regulation

In general, voltage on the main receiving buses at the terminal stations and principal high voltage distribution stations is maintained at a reasonably constant level. Generating stations, particularly those on the upper St. Maurice and those in the Shawinigan area, are operated at variable voltage, depending upon load conditions. The 130-kv. system operates at a variable voltage and at Shawinigan Falls, Trois Rivières and Sorel, the voltage is varied between 110 kv. and 134 kv. This facilitates maintaining suitable voltage at distribution stations to provide for load variations. Fig. 5 is the voltage control diagram. Regulating transformers, or on-load tap changing gear, have been provided at Grand'Mere, Shawinigan Falls, Trois Rivières and Sorel to regulate voltage on the 130-kv. system.

On the South Shore system, regulating transformers or on-load tap changing gear have been installed at Hemmings Falls, Asbestos, Victoriaville and Quebec in order to regulate

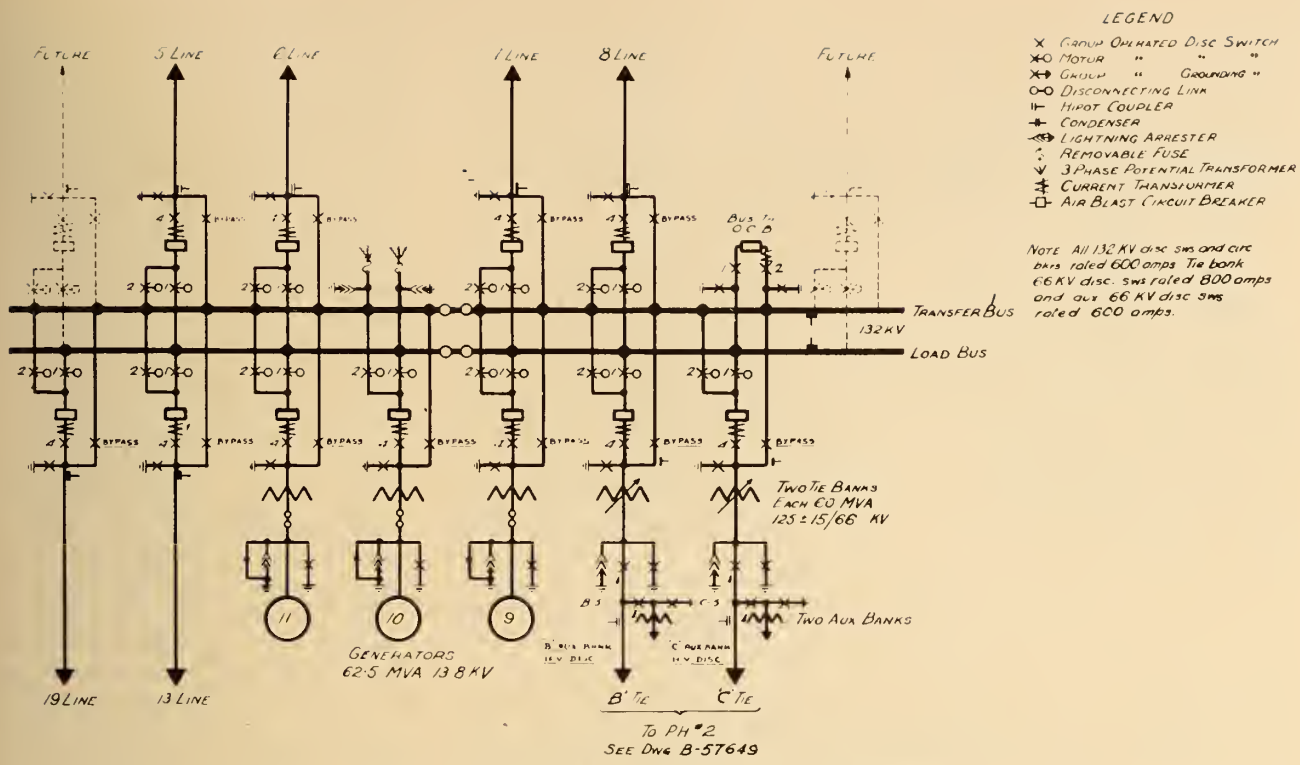

Fig. 7. Generating Station No. 3—Shawinigan Falls.

the 66-kv. voltage on the section supplied from these stations. At Quebec there is a 30,000-kva. plus and minus synchronous condenser, and this machine is used to regulate voltage on the 66-kv. bus at Quebec, in addition to providing reactive power. Provision has been made for the installation of a second synchronous condenser when required and it is probable that the second unit will have a capacity of about 45,000 kva., 100 per cent plus and 50 per cent minus.

Power Transmission

In the past it was possible to install 75 per cent to 80 per cent power factor generators on the lower St. Maurice and provide required reactive power in this manner. However, as generating stations were constructed farther from load centres and as the transmission system was extended, this method of providing reactive power to load centres became uneconomical. During the past few years, about 150,000 kvar. of shunt capacitors have been installed on the high voltage power system. These may be divided into two main groups: (1) large manually controlled units of 15,000 to 20,000 kvar. capacity which are installed at terminal stations, and (2) small low voltage automatically controlled installations of 800 to 3,600 kvar. capacity which have been provided at a number of distribution points.

It is probable that, in the near future, installations will be completed for operation on voltages up to 66 kv., as compared to a maximum of 13.8 kv. on existing installations. The cost of power transmission and distribution, including transmission losses, is influenced by the power factor of the transmitted load. Considerable progress has been made towards improving power factor by installing reactive power at load centres. Moreover, during light load periods of the year certain

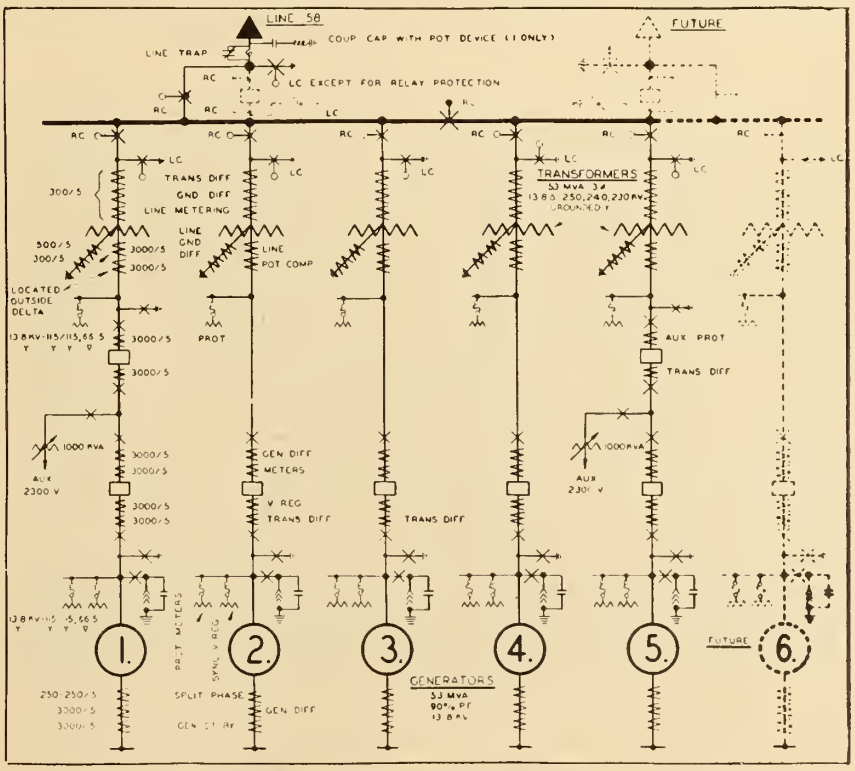

Fig. 8. Trenche Generating Station.

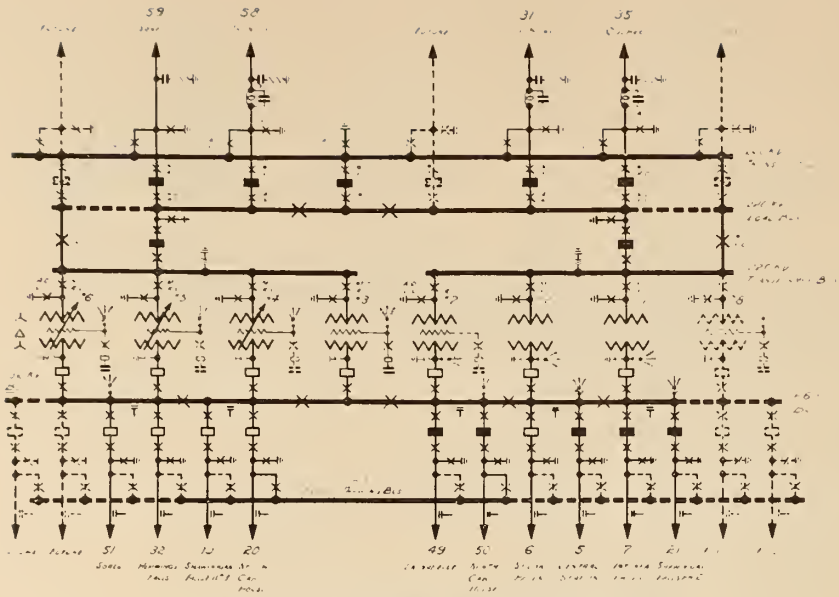

Fig. 9. Trois Rivières Terminal Station.

hydro-electric units are frequently operated with the draught tubes vented to permit operating these generators as synchronous condensers.

It is possible to interchange 150,000 kw. in either direction over the 130-kv. tie lines between Shawinigan and Montreal. This is facilitated by raising the Shawinigan voltage to 134 kv. when supplying maximum power towards Montreal. When transmitting power to Shawinigan Falls from Montreal the voltage at Shawinigan Falls is reduced to a minimum of 110 kv. In this method of operation, the reactive power is supplied to the lines at Shawinigan Falls and remains reasonably constant, regardless of the amount or direction of power flow.

The transmission situation between the Saguenay and Quebec systems has differed in this regard. The voltage at both the sending and receiving ends of the two transmission lines was maintained at a comparatively fixed value of 180 kv. at Ile Maligne and 155 kv. at Quebec for a load delivered to Quebec up to 200,000 kw. This has been accomplished by varying the amount of reactive power supplied between these systems. At times it has been necessary to reverse the power flow on these two lines for a load delivered to Ile Maligne up to 150,000 kw. In these cases the Ile Maligne-Quebec lines were connected metallically to the Saguenay 154-kv. system, resulting in essentially flat voltage transmission, with the reactive power supplied from the Saguenay system.

The double circuit line between Quebec and Ile Maligne has now been converted to 230-kv. operation. This conversion has increased the transmission capacity by at least 50 per cent, which would correspond to a third line. Normal operating voltage will be 240 kv. at Ile Maligne and 220 kv. at Quebec. At Ile Maligne the Saguenay Transmission Company has installed three 150,000 kva, 3-phase, 160 kv./250 kv. auto transformers. These transformers will be operated solidly grounded neutral, without tertiary windings. The two transmission lines to Quebec are equipped with single pole switching and automatic reclosing.

The upper St. Maurice lines are each designed to deliver 250 mw. at 100 per cent power factor to the Trois Rivières terminal station, an average distance of about 100 miles. These lines operate radially at present, but eventually, as more lines are constructed, some form of interconnection between lines will be provided in the upper St. Maurice. At that time single pole switching and automatic reclosing will be extended as required. In the ultimate development of the upper St. Maurice, there will be a total of four or five 230-kv. lines to the terminal stations.

Electrical Design of Stations

Generating Station No. 2 at Shawinigan Falls

The electrical layout of this station has recently been rearranged and Fig. 6 indicates the transition from the original low voltage bus scheme to the more recent unit system. It should be noted that this is an indoor type of station and, prior to 1920, indoor generating stations were constructed with low voltage buses and associated switchgear. After this period, design practice was changed to the unit system and this applied in the first instance to units Nos. 6, 7 and 8 at this station. This policy has been extended to all generating stations constructed since that time. In the unit scheme, the generators are operated isolated neutral with an alarm for ground faults. The more important features at No. 2 Generating Station are two 66-kv. buses, the transfer and sleet thawing bus, single phase indoor power transformers, B and C tie line connections to No. 3 Generating Station and provision for utilizing one of the large generators for sleet thawing on 66-kv. lines.

Generating Station No. 3 at Shawinigan Falls

The more important features of this layout (see Fig. 7) include 3-phase, outdoor power transformers, load and transfer bus arrangement, 130 kv. airblast circuit breakers, provision for sleet thawing on the 130 kv. lines and two 60 mva, 3-phase on-load tie banks which connect the 130 kv. and 66 kv. systems between Generating Stations Nos. 2 and 3. All 130 kv. switching equipment is located outdoor on the roof of the Generating Station. This includes bus work, disconnecting switches, airblast circuit breakers, potential transformers and lightning arresters. Power transformers are located in open bays on the upstream side of the station. The generators are rated 50,000 kw., 13.8 kv., 80 per cent power factor and are water-cooled.

Trenche Generating Station

The main design features of this station (see Fig. 8) include: 50,000 kw., 90 per cent power factor, 13.8 kv. water-cooled generators; 53,000 kva, outdoor, 3-phase, 13.8 kv. 250 kv. F.O.W.C. power transformers with 230 kv. insulation graded to 25 kv. at the neutral; provision for sectionalizing the 250-kv. bus to permit operating the station on two separate lines in the future; 250 kv. airblast, outdoor circuit breakers on the high voltage lines only; carrier current relaying on the 230-kv. line, in association with single pole switching and automatic reclosing; and air-operated disconnect and grounding switches.

The Trois Rivières Terminal Station

Design features of this outdoor station (see Fig. 9) include: the main 230 kv. load and transfer bus arrangement; 230-kv. airblast circuit breakers with single pole switching and automatic reclosing on two

of the 230-kv. lines; four 50-mva, 3-phase, 230-kv./66-kv. outdoor F.O.F.A. power transformers; four 50-mva, 3-phase, 230-kv./115-kv. outdoor F.O.F.A. power transformers with separate regulating transformers in the 115-kv. neutral; a single 230-kv. airblast circuit breaker for each group of four 50-mva. transformers, and 15-mva. shunt capacitors connected to the 11.5-kv. tertiary windings of the 50-mva. power transformers.

Miscellaneous

An adequate relay protection has been provided for each element of the power system. Instantaneous forms of protection are used as far as possible. This is accomplished by such means as: differential protections for generators, buses and transformers, directional impedance and carrier relaying for transmission lines and supplementary features as required. Automatic reclosing of transmission lines is used extensively to assure maximum service reliability, and this application is being extended as rapidly as conveniently possible. Single pole switching and automatic reclosing has been applied to a number of 230-kv. lines. Metering includes kilovar meters and telemetering between main generating stations and the System Office for operational purposes. The company operates an extensive telephone and carrier communication system with suitable exchanges at the various stations or operational headquarters.

Special attention is paid to lightning protection at stations, including such features as low resistance grounds, overhead shielding and connections to transmission line O.H. ground wires. Distribution type lightning arresters are frequently connected to the 66-kv. terminals of power transformers. On the larger 130-kv. and 230-kv. installations, it has been the practice to install station type lightning arresters on the respective buses, particularly where the transformers have reduced insulation. During the past few years considerable progress has been made towards the improvement of transmission line service, with particular reference to lightning protection. This has been accomplished by the installation of overhead ground wires, buried counterpoise wires and keeping ground resistances to a minimum.

Three-phase, outdoor, forced oil cooled transformers are favoured for the large terminal and generating stations. The choice of on-load tap changing gear, or separate regulating transformers usually depends upon local requirements. Separate regulating transformers have, in the past, been used on 50,000 kva. transformers of 230 kv./115 kv. rating. It is probable that in the future preference will be given to the installation of on-load tap changing gear on new installations of this rating. There are in service a number of transformers of various ratings and voltages up to 60 mva. and 130 kv. which are equipped with on-load tap changing gear. Where regulating equipment is required at the smaller distribution stations, preference is usually given to 3-phase transformers with on-load tap changing gear. However, this practice is often influenced by voltage requirements on the low voltage bus and associated feeders. In some cases preference is given to the installation of either bus or feeder regulators. In these cases, single phase power transformers are usually installed. particularly where the individual bank capacity does not exceed 12,000 to 15,000 kva. Recent policy on the solidly grounded star systems is to install power transformers with an insulation level one grade below operating voltage and provide adequate lightning protection. At the large stations where there is an adequate water supply, recent practice is to install 3-phase, forced oil water-cooled power transformers. Where the water supply is inadequate forced oil forced air-cooled power transformers are installed. In the smaller sizes, up to about 10,000 kva., outdoor oil insulated self-cooled transformers are usually provided.

Single tank oil circuit breakers with high speed and high interrupting capacity characteristics are being used extensively on voltages up to 130 kv. Airblast circuit breakers are being used on voltages up to 250 kv. In most cases the airblast circuit breaker design permits each phase to be operated independently and this arrangement facilitates the application of single pole switching and automatic reclosing. The oil circuit breaker provides a ready means of installing current transformers on all bushings for metering and relaying and this facility has proven of considerable advantage.

It will be noted that in recent years all major switching and transformer stations are of outdoor design. This applies not only to station buses but also to equipment such as power transformers and switchgear. Twenty-five years of experience has indicated that the outdoor type of station is quite suitable to meet Canadian climatic conditions.

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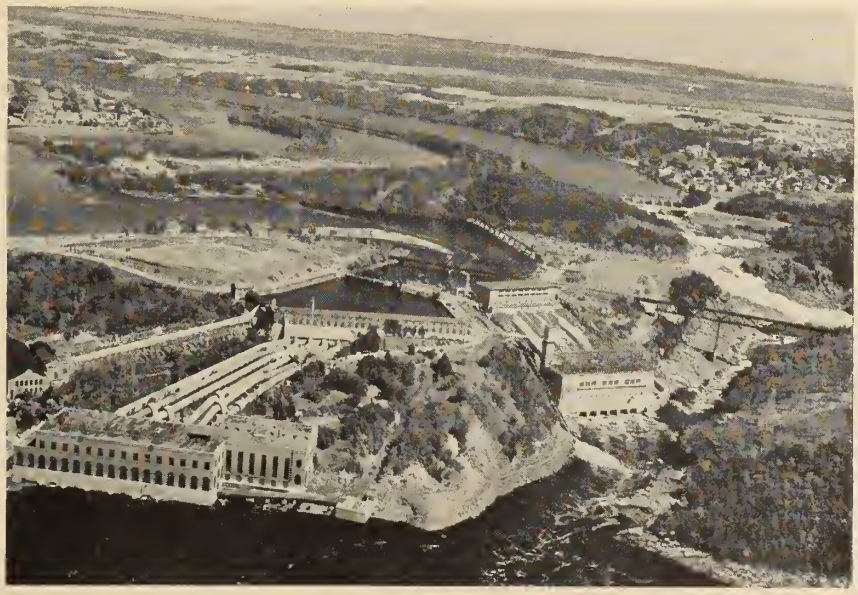

Fig. 10. Hydro-electric generating stations of The Shawinigan Water and Power Company on the St. Maurice River at Shawinigan Falls, Que. With a present capacity of 416,500 hp., these stations have grown from two 5,000 hp. generators when the company's first installation was made on this same site 50 years ago.

Management, Safety and the Engineer

A panel discussion held at the Sixty-sixth Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, May 9, 1952

Chairman

Dr. Lillian M. Gilbreth, *Hon. M.E.I.C.*,
Consulting Engineer, Montclair, N.J.

Panel Members

A. Francis, *Vancouver*
J. B. Biker, *Trail, B.C.*
A. B. McEwen, *Vancouver*
I. F. McRae, *Toronto*
R. Elfstrom, *Vancouver*

Chairman's Remarks

The subject of the panel has to do with Management, Safety, and with it the Engineer.

Management deals with the whole framework in which we work in the industrial and business field, and certainly we know very well that it has not only the know-how which takes over our skills and our use of materials and machines and techniques, but it also puts a strong emphasis on human relations. I am saying this merely in an introductory way, because it is the direct responsibility of all of our panel members to give our interpretation of all these terms which are in our title.

Safety, of course, is the subject of the discussion, and a very appropriate discussion at any time, especially today when we are so cognizant of the importance of waste and the need for conservation and the use of every resource we have; knowing that human waste is the most important waste, most of our emphasis will be there.

Also we have directed our efforts toward the work and the responsibility of the engineer. It is a very different panel, really, and very different in its treatment than any one using the same title before a more general audience. Our audience is distinctly an audience of engineers. Our participants are engineers, and it is that emphasis we are bringing before you this afternoon. This panel was planned by Mr. C. A. Peachey and I am sorry he is not here to preside over it today. In inviting guests for the panel, his objective was that each one would represent certain interests and areas of activities.

May I introduce first Mr. Arthur Francis, chief inspector of the Workmen's Compensation Board for the Province of British Columbia.

The next panel member, Mr. A. B. McEwen, western manager representing Canadian Industries Ltd., a graduate of R.M.C. and McGill and Assistant Chief Engineer of C-I-L. since 1929.

Our next panel member is Mr. John B. Biker, director of safety, Consolidated Mining and Smelting Co. of Canada Ltd., from Trail, British Columbia, a graduate in logging engineering at the University of Idaho, U.S.A.; a member emeritus of the American Society of Safety Engineers, and who has served with the Royal Canadian Engineers.

Mr. I. F. McRae, assistant to the vice-president of Canadian General Electric Company, from Toronto, member of the Institute of Professional Engineers of Ontario, 27 years' experience in the Peterborough works of C.G.E., and at present assistant to the Vice-President for Planning and Services.

Mr. Roy H. Elfstrom, supervisor of industrial safety, British Columbia Electric Co. Ltd., engineer, British Columbia Electric, Canadian Government Industrial Hygiene, Mining Defence Industries, etc.

I shall introduce the speakers very briefly just by name and his area of interest.

Mr. Francis is going to give us a look at the general principles relating to the accident picture, and also something about the terminology that we use.

Mr. Francis: The first thing to decide is whether or not this problem is sufficiently important to justify the time and effort devoted to it. Last week in Vancouver a shipwright was climbing a ladder with a bucket of paint. As he was climbing up the ladder, the ladder slipped. He fell a distance of about 14 feet and was killed. He left a widow and a young daughter. From industry's point of view that represents possibly an expenditure for the widow and dependent of around $10,000. About a month ago up in the Cariboo a young truck driver, 21 years old, married, was sitting in the cab of his truck. They were conducting some blasting operations nearby. A large

chunk of wood flew through the air, landed on top of the truck, crushed in the cab and crushed in this young driver's head. Head injuries are rather a serious proposition. He ended up being 100% disabled for the rest of his life — a young man just in the prime of life, possibly representing our greatest asset, has become a liability to society as a result of that accident. The award necessary to pay him for the rest of his life was $40,000 odd. The medical attention he required brought the total expenditure to close to $50,000. In other words, the bridge they were building cost $50,000 more than it should have. The contractor, naturally, does not pay directly that $50,000, but the industry as a whole pays it, and in the end society pays it.

In British Columbia every year we have more than 70,000 claims. Close to 30,000 of those claims have time loss. The average last year was 58 days per case. We have roughly about 275 fatal accidents in British Columbia, we have about 1,200 workmen who are injured and left with some permanent disability. The cost to industry in British Columbia is approximately $16,000,000, and because the legislature has recently made an increase in the benefits, you can certainly expect, at the present rate of accidents, your accident costs to rise considerably. The picture throughout Canada is very much the same. We have in Canada approximately half a million claims for compensation every year as a result of industrial accidents, including about 1,100 fatal accidents. The cost to industry—$75,000,000.-00 for compensation. What does that represent in total accident costs if you apply all the well-known indirect costs with a ratio of approximately four to one? $400,-000,000.00 a year is the cost to industry for industrial accidents.

Is the problem important? I think so. Here we have this continual waste, which is undesirable, unnecessary and uneconomical. I can't help but say this, that I do not think that industry has fully recognized its obligations to society in permitting this high accident rate to continue. So much for the picture. I merely wanted to give you those few statistics to let you know that the subject is mighty important.

First of all you should know your accident score. The standard method is to compute your accident performance record in terms of frequency and severity rates. Frequency rate is the number of accidents per million man hours worked. The severity rate is the amount of lost time days per 1,000 man hours worked. Your severity influences your cost, but if you are trying to control accidents you must control your frequency rate.

Having found out whether or not your performance is good, bad or indifferent, you must then find out how, when where and by what means accidents are occurring in your particular operation.

The dictionary says an accident is a fortuitous event, in other words a happening by chance. As engineers you realize that you cannot have effect without cause, and an accident follows a law of cause and effect just as much as any other condition does. Accidents happen invariably because circumstances and conditions have been permitted to get into such a condition as to have the inevitable result.

You must not confuse injury with accident. You might even want to determine the difference between minor injury and major injury. I think that in thinking of terms of severity of an injury, you should measure them not in results or effect, but rather in the potential effect. For instance in our sawmill industry one of the normal hazards is to get slivers. Well, except that if a sliver is neglected, and infection sets in, a sliver is a minor injury. Again you might have other work in a shop, where you may get injuries such as a foreign body in the eye; here the embedding of a foreign body in the eye is possibly endangering the sight of that eye. So you have two cases there of minor injuries, one with a high potential of injury and one with a low potential. Generally speaking we measure injuries in terms of whether or not they are disabling or otherwise. To obtain compensation, an injury must be disabling, the disablement may be of a temporary nature or it may be of a permanent nature. And finally we have, as far as injuries are concerned, your fatal injuries.

Most people speak of a machine as being the cause of an accident while actually it is the agency involved in the injury. When you speak of accident causes, that cause should indicate the corrective action. 80% of accidents have a physical cause and personal cause. Physical causes are such things as lack of guards, inadequate guards, etc. de-

The discussion panel.

fective equipment, hazardous arrangements, and those things of a physical nature which are subject to control or correction. In the personal causes, first of all we have lack of knowledge or skill, or we have physical, mental or emotional defects, or we have improper attitude. In other words, in the case of personal causes, is the man able to conform to the standard procedures and practices, or, are the conditions such that he can and he won't. In short, improper attitude. And don't let us dismiss improper attitude as having one single sub-cause, because you can go into a big field of improper attitude.

I want to emphasize, there is no such thing that I know of, as an accident that is an Act of God. They exist, possibly, but in most cases you can usually find very definite causes. Most accidents are preventable, preventable in a practical way — it is economical to prevent them, and they should be prevented. I think that if, then, my definition of an accident is an unplanned event, the cure for accidents is complete planning of industrial processes. I think that I am going to throw right into the laps of the engineers the responsibility for the majority of accidents that are happening in industry.

Chairman: Mr. McEwen represents mechanical industry, and has been kind enough to take over any questions which might fall into the field of construction, as he has had experience there. He is going to talk on the place of the engineer in safety work.

Mr. McEwen: Mr. Francis has already outlined to you the necessity for proper measures to prevent accidents. I am going to try and explain to you some of the precautions that can be taken during the design and construction period of plants, to avoid accidents during the construction period and also those occurring after the plants go into operation. In the first stages of a new plant design — of course, management, top management, have to make the decision that a plant will be built. I believe that modern management, once they have made that decision, should instruct their own engineers or consulting engineers who may be designing the plant, that proper safety precautions must be installed in the plant to insure that a minimum number of accidents will occur.

Among the more important of these are: First, safe and economic measures for the handling of all materials, materials in process and finished product; next, the design of equipment so that it can be operated with a minimum hazard to employees; next, suitable passageways, walk ways for the moving of materials, the operation of the equipment and the maintenance of the equipment; next, the installation of belt guards, guards for moving parts of equipment, safety signs, or any other thing of that nature that would indicate that there is a hazard in a particular operation or movement of materials. The next item would be proper illumination, so that the employees can see what they are doing and can operate their machines and equipment with a minimum of danger. Another one to which enough attention is frequently not paid, is the reduction of noise, in that noise is a cause of fatigue in employees, and some consideration should certainly be given to that aspect of Safety.

Another aspect of the design that should be given consideration is the safety of construction. Quite frequently engineers, during the design stage, pay no attention whatsoever to whether a building can be constructed safely — or bridge, or whatever it may be — but I think that it is a very important phase of the work as well.

Those are the more important points to which the engineer will have to give some consideration during the design stage, but during that stage it is my belief that the engineer should be in constant touch with the operating department, the people who are going to operate the plant, to make sure that they go over the plant lay-outs very carefully to ensure that the operations as they visualize them can be carried out safely. The safety engineer, if there is one at the head office of the company, or if not the man who is going to be in charge of safety at the plant, should also be brought into the picture. He should have an opportunity to study the plans, designs, plant lay-outs, etc., and satisfy himself that he afterwards can get the employees enthused to operate the plant in a safe and satisfactory manner.

Chairman: Mr. Biker represents the mining industry, and will handle questions and carry the engineer out into action, into the operations in the industrial field. He will present to you the kind of problems that come up there, and the ways in which these problems are met.

Mr. Biker: My portion of the program is, as you have heard, the engineer in action. I would like you to assume in starting that we will all agree that industrial safety is part of our daily lives. I think that our professional organizations have in the background the main theme, protection of the public. We are organized so that our building standards, our construction standards, everything, is along lines of the maximum amount of protection for the public. Therefore I think that this progam of the engineer in action is well taken. An industrial accident represents a definite failure in the use of one of the four, manpower, material, machinery, or methods. These are commonly called the four "M"s". It means a failure somewhere along the line in the engineering. I suggest as an example, it may have occurred on the drawing board, it may be on the flow sheet, the process of the plant, it may be in the safety limits of the equipment. Where does the engineer fit into the picture ? First of all, are they provided ? Are they available ? The answer to that is yes and no. Our major industries, our larger plants, have engineers. Smaller ones have not. If we have them, where are these engineers required in safety ? In industrial operations there are two main functions, one is a staff function, and the other is the line function. In staff functions, you have the management and research and all your services. In your line function you have your operation and your maintenance. Engineers are required in all these functions.

How can we use engineers ? In my opinion we can use them in the proper assessment and analysis. Engineers have knowledge of the basic sciences, can make a plan which is of an orderly type. Every job, no matter how menial, still requires a job analysis. When the analysis is made, then we can fit the type of manpower to that job. Moreover, engineers have the ability to assess a part or all of that job. I would like to leave this with you, that if engineers do their job in industry, we will have a lot lower frequency rate.

Chairman: Mr. McRae represents manufacturing industries, as you know. He is well fitted to talk to us about utilization. We have had some discussion now about what the problems are and the ways in which we are meeting the problems, and now we go directly out into industry to see what is happening there.

Mr. McRae: This industry that we are talking about today, is a half billion dollar Canadian industry, an industry that contributes abso-

lutely nothing to the economic life of our country, an industry that gives us endless opportunity for service, and service of a type that engineers can render better than any group that I know. In this program of ours, of safety, or injury reduction, education is one of the serious problems with us today. Education goes hand in hand with this industry — or lack of education goes hand in hand with this industry, and the problem with us is that we are not organizing or developing our educational plans along the lines that will tend to reduce our accident rate. In bringing a new employee into an industry, and when I say industry I cover every type of employment, one of the main things that should be done is to make sure that the employee has a full knowledge of what that job is, has a full knowledge of what is expected of him in his day to day work. Management has laid down the general principles of operations — they have laid down the plans that must be followed, and they should expect that anybody coming on the payroll will give them the necessary respect and assistance in carrying out those plans. A man must be told what management has provided. He must be told what the policy is and how that policy will be carried out. Management in turn must be expected to recognize that the man or woman working in the industry can expect good working conditions, working conditions that will protect them all during the period that they are working for that company or individual. The men and women working today must expect safe equipment on the job. It would be unthinkable to ask anybody to come in and work for you and provide those people with unsafe working conditions. The conscience of any decent person just would not stand that type of thing.

Now in this industry of ours, we find that over 60% of the accidents in industry today are what we might term man controlled or man directed injuries. Mishaps in material handling, or the falling of persons or objects represent causes of the great majority of accidents. In that category I would consider this group as man controlled, or man directed, or man's responsibility. The engineer has been given a scientific education, an education that will permit him to analyze, to assess, to direct. The engineer has an opportunity in this accident prevention and safety business that is without parallel in any of the industries in our country today. For any man who can go into a half-billion dollar industry and make a saving of even $100,000 today, it will be well worth his while.

We may talk about the economic side of accident prevention. If we can reduce our accident costs by 25% then we in turn will reduce the number of injuries to persons and probably the number of deaths. In Canada last year over 1,100 people were killed in industrial accidents. If we could reduce that 10 per cent, or 20 per cent, it would be well worth while and we would be preserving the human assets of our country.

Chairman: Mr. Elfstrom represents utilities. We have asked him to take over the subject of the workers' right and responsibility, and we have asked him to please include the physically handicapped worker, which is a subject of great interest.

Mr. Elfstrom: "Labor has its right to safe working environment." Let me enlarge on that slightly. By safe working environments I mean not only the plant facilities, such as were described under the designing phase, but also safe work practices, procedure, and so forth, after the plant is in operation. By plant I am referring to any kind of industrial operation. In this operation of the plant, man is not a machine which is to be manipulated as you would manipulate machines — put one machine here, and one machine there, and it is supposed to go most efficiently. I think that engineers in general have a tendency to manipulate people as they would manipulate machines. On the other hand at least we should give the same consideration to a human being that we give to a machine. For instance, when we go to buy a machine we properly select it. We should properly select a person. We should properly place him, just as we properly place a machine. Proper selection should be from the physical aspect, and it should be from the mental or psychological aspect, as well as from that of ability.

The second point is that you should practise preventive maintenance on man, as you would on a machine. By that I mean that we should not wait for an injury to happen before we do something about it. Having a machine, you oil it and grease it, take it apart and put it together again, and so forth. You should see what makes a man tick and see that he operates properly too.

You must give proper training to the person. In my opinion there is not such a thing as an accident-prone worker. That may sound peculiar coming from a safety man, but I think that if a person is properly selected and trained and supervised, he won't have any accidents, and the most important part here is the placing and training.

There is one more point concerning the rights of the person, a labourer or labour, and that is that they should have a voice in their own working conditions. I may be digressing a little on labour management relations, but if you ask the average worker for his suggestions, and act on them, you will get very good returns on your investment. It might even surprise you a little. It goes for engineers just as much as it does for all management of which engineers are a part, that one can get a lot of good ideas from the man working in the field. He puts in all those working hours, and he has to take the good with the bad and at times has various ideas.

I have talked about rights. I should say something about responsibilities. They must abide by the rules that are set up as long as the rules are workable. They must co-operate, and in that particular phase safety is the one place where you have very good co-operation. There should be no disagreement as to what is safe and what is unsafe. I think you can draw a pretty sharp line. Safety is one of the non-controversial subjects upon which labour and management can get together to their mutual advantage.

In conclusion I would just summarize by saying that I think that a worker has a right to a safe working environment, which must be provided by management and the engineer can go a long way in helping management to provide that safe working environment.

Discussion

Mr. Biker: I understood Mr. Elfstrom to say that it was the right of labour to bargain on safety questions. I don't think you can bargain with safety or that it should be allowed to creep into a bargaining session.

Mr. Elfstrom: That is one point on which there should be no argument in labour management relations; safety is in the interests of everyone. I do think that it would be a good idea to have articles in the union agreement concerning the policy about safety, but I don't think that it is right to, say, pay a man extra because he is supposed to have a more hazardous occupation. That is wrong in principle. You should provide safe working procedures. If a job requires more skill then pay

him for more skill, but don't pay him for taking a chance.

Mr. Biker: Would Mr. McRae infer that we are not doing enough training?

Mr. McRae: I don't think we are doing anywhere near enough training. We take a person into a job and show him, point the job out to him, but we do not give him the background or responsibilities for the hazardous portions of the job, or instruct him adequately in the safe way to work. There is always a safe way and an unsafe way to work. I don't think we are carrying on our safety programs as effectively as we should. In the larger industries a great deal is being done, but the majority of the working people today do not work for large industries. They are working for industries who employ 200 or less, and there is a great lack of education in these smaller industries. Even the larger industries might take upon themselves the possibility of encouraging educational forums to allow the people in the smaller industries to take advantage of the educational work that is being done in the larger industries. The larger industries have more money to spend and can do the job probably more effectively. At the University of Western Ontario, they have around a 9-week course on safety, and the attendance has been very large. Other schools across Canada could well take a leaf out of the book of Western Ontario and run these forums. It would be good for supervision and certainly it would be good for the average person in the plant. Unfortunately the average person in the plant is not interested in many of the safety campaigns that go along with the job. Labour itself could do a great deal to sponsor these safety campaigns and safety educational campaigns.

Chairman: Mr. Francis what do you think about how effective education is?

Mr. Francis: I am convinced, and I have plenty of evidence, that management is not fully aware of the accident prevention problem. I consider it is up to management to do some self-development. I don't think they can pass the buck by saying why doesn't somebody tell me these things. If management subscribes, for instance, to a good trade magazine, contained in that trade magazine will be ample information on how they should assist themselves. I am convinced that management is woefully lacking in up-to-date knowledge of industrial organization and the need for carrying on from there for the common welfare.

Mr. McEwen: I would like to ask Mr. Francis if the Workmen's Compensation Board is doing anything to educate management and does it offer any inducement of lower rates for industries that have good records?

Mr. Francis: Yes, the Compensation Boards inform industries of the facts. They try to educate industry as to the conditions, they try to inspire industry to do something about it, and generally keep them informed and make themselves available as far as giving them know-how, a consulting service, and everything else. In answer to the last question as to whether they endeavour to reward good performance, yes and no. Actually, industry is divided into sub-classes. We have a couple of hundred sub-classes, and each sub-class controls its own accident costs, its own accident experience. There is only one way to reduce accidents. If they reduce accidents as a group, they reduce their costs. That in itself is almost a self-insuring principle by groups. In addition to that, in certain classifications there is an experience rating system, which will influence the rate which is charged to each particular plant.

Mr. Biker: In regard to Mr. Francis' statement that management needs education, I take exception to the method of presenting it that way. I don't see how management, with all the problems they have in common industry now, every industry, can keep abreast of the problem unless they have advisers. I blame safety people, whether it be the personnel people or the safety people belonging to the personnel, for not advising management of the problem and keeping them informed so that any necessary action may be taken. I don't see how you can rely on management to go out in the field and grope, and, as he infers, educate themselves in the safety field.

Mr. Francis: In answer to your statement, your personnel department heads are part of management. If they have failed in their job, then top management has failed to make them carry out their job properly.

Your entire line of supervision, right down to the last individual who is directing the activities of the men, is management.

Question from the Floor

I would like to ask Mr. Francis what influence the union has in the field of safety.

Mr. Francis: The legal responsibility for accident prevention rests on management, as well as a moral responsibility. Labour, organized or unorganized, individually or collectively, has a moral responsibility to prevent accidents. The individual has a responsibility to guard his own welfare. Organized labour can do a great deal in demanding that its members accept that responsibility. Organized labour can do a great deal in educating and inspiring its members to work safely.

Chairman: We have a question here I think for all of us. "The panel has made an excellent presentation, however I am under the impression that the members accept the principle that some accidents are inevitable. I believe that the greatest progress will be finally achieved when top management starts with the fundamental policy that no accident is inevitable. Would the panel care to comment?"

Mr. Elfstrom: If I get the slant of the question right, I would say that accidents are not inevitable, that you can prevent them, that they can all be prevented, other than maybe a very small amount that are caused by tidal wave, and earthquake, and things like that. The average run of accidents can be prevented, by proper job methods, by proper design, proper placement, and so forth.

Mr. McEwen: I believe that I would take issue with Mr. Elfstrom on that point, that all accidents can be prevented. I think we can work along to that end, and if our foresight were always as good as our hindsight, we could probably design plants to prevent most accidents, but even if we had the perfect plant I do not believe we can always prevent a careless workman from putting his hand into a saw, or doing something of that sort.

Mr. Biker: I think we have to work on the fact that we can stop accidents. It is a thing that I am continually fighting, with a large group, especially in the mining industry, who are working, you might say, against Nature more than probably anyone else. They all claim, or used to claim, it is an Act of God, when there is a rock slide, and so forth. If all of these accidents are analyzed, there are phases and features of them that show that the proper study and job method was not used. I will also make a bet that you will find that there was a failure in engineering planning.

Mr. Francis. Every industry has a different degree of hazard associated with it, and within that particular industry, each individual operation

has a certain variation in normal inherent hazard. As a safety man, I am not worrying about those accidents which are part of those risky operations. I am concerned first of all with cutting down those unnecessary accidents.

Mr. Elfstrom: We usually find that when the going is the toughest the accident rate falls and when conditions get good then the accident rate rises. Why ? Because the average person is probably less concerned about what the next step is in his job procedure if he doesn't have to worry about it because of some other danger that is surrounding him.

Mr. McRae: I don't think there is any such thing as a hazardous industry. There are many hazardous people, but there is not a hazardous industry.

Chairman: Mr. Francis, there is another one here for you. How does the percentage of payroll costs of the W.C.B. for British Columbia compare with the other provinces? If the rate is higher than the average, with 275 deaths out of 1,100 for Canada, it must be, What is the reason ?

Mr. Francis: Unfortunately we do not have sufficient statistics in Canada to make an intelligent answer to this question. There are variations in benefits, variations in the writing of the Compensation Acts themselves, and in this past year or so there have been alterations in several of the Acts. You mention the fatal accidents, well again that may be due to the fact that in British Columbia we have some basic industries, which, in spite of the remarks of my colleague, are hazardous.

Chairman: We have several questions here which are closely related. There is one to you, Mr. McRae, "Is there any method which stands out above others in selling safety ?" One has here, "Can safety prizes be considered as an incentive in safety? What success has been experienced in the reduction of accidents by instituting competitive incentives between respective branches of an organization ?"

Mr. McRae: That lines up with another question I have here, Dr. Gilbreth. "What is the value of slogans, competitions, graphs and publicity ?" I think I can cover the whole thing. I think there is a great deal of value in slogans, competitions, graphs and publicity, posters and things like that, providing they are followed up on a constant and continuous basis. I don't think any over-all safety campaign will be effective unless it is run twelve months a year, and we must recognize the fact that safety is not a periodic business.

Mr. Biker: Mr. McRae, with regard to incentives, and so forth, I infer he means by incentives to attract the employee to the problem of prevention of accidents — not as a bonus for working safely.

Mr. McRae: I don't think you are entitled to pay the employee for working safely. You are entitled to give him a penalty if he doesn't work safely. He is supposed to work safely all the time. You are putting a premium on safety.

Chairman: "Where the worker bears some of the compensation cost, is there any tendency for less accidents ?".

Mr. Francis: The only place that I know where the worker contributes to compensation is in Great Britain, at the present time. The workman does not contribute to compensation in British Columbia, although — sometimes people forget, that all the social benefits that a worker gets actually come off his pay cheque. I mean by that, supposing that the union asks for 5c. an hour for a welfare plan, administered by the union. Well, that welfare plan is money that is taken off the wages of the worker, or it is additional wages which he does not get. The same applies to compensation. It is costing industry so much per man to keep him on compensation. If that money did not go to compensation, then it would be available for wages.

Mr. Francis: When our Act was written in 1917 it was felt that the worker by a contribution of one cent per working day would contribute enough to pay for medical aid. Because a workman was contributing, he felt that he was buying insurance and was entitled to benefits whether he got injured or not.

Mr. McEwen: I have a question, "From the example of C.I.L.'s nylon plant, I am wondering if their seemingly extravagant expenditure on safety is predominantly an investment, financial, or more for the purpose of philanthropy and public relations".

My comment on that question would be as follows: I think "seemingly extravagant" is probably right, because from my little knowledge of the expenditures on safety at the nylon plant I would say that they are relatively small compared with the total payroll of the plant. There is one other angle, and that is that the accident prevention programs do tend to establish good employee relations and a better employee morale. I think those are the primary reasons for C.I.L.'s accident prevention programs and seemingly extravagant expenditures.

Chairman: We have one here: "3,500 men with union support, working in the shipyards, recently refused to wear safety hats. How would you cure this attitude in such cases ?"

Mr. Francis: The logging industry of British Columbia is suffering a high percentage of serious accidents due to head injury. We passed a regulation — now regulations are passed after public hearings in which labour, management and government discussed the problems — so it was agreed that a regulation would be passed making it compulsory for men in the woods to wear safety hats. They are wearing them.

Chairman: Can accidents be prevented without regular medical examination ?

Mr. Biker: I think it is becoming more common, everyday, for pre-employment examination. A man might be a very good chap, but he might have an ailment of the feet.

Mr. McRae: I have a question here: Would you care to point out the importance of good housekeeping in insuring safe working conditions ? This depends on the vigilance of supervision. I think good housekeeping is one of the prime points in a good safety program, and you can't wash it down under any circumstances.

Mr. Francis: How can the engineer influence workmen and management along safety lines. I think very easily. The engineer has special training. He is supposed to understand cause and effect and the reason for various methods being adopted. He has prestige. He has the respect of the workers. If an engineer has one eye on the hazards of any particular job, and tells the workman that it would be wise to do certain things, I think that the workman would consider that he would be doing the smart thing, the workmanlike thing, the skilful thing, by following the instructions of the engineer.

Mr. McRae: Larger industries have the advantage of engineering staffs, but a good portion of the accidents come from other than large industries. That is just to defend the engineer a little bit.

Chairman: No one has spoken definitely of the safety engineer, who has had special training in that field. If we had a special safety engineer, with special training in that field, that would be all to the good, would it not ?

Mr. McRae: There is a great field

in this country for safety engineers and safety engineering.

Mr. McEwen: The question is: You mention noise as a safety hazard from a fatigue point of view. How about noise as a health hazard. Is this issue not being side-stepped by industry? I think that if we accept the fact that noise causes fatigue, I think we will also readily admit that a person who is tired is much more likely to pick up a germ and become sick, and consequently there is a health hazard.

Mr. Biker: Does work tempo affect safety? I think it will be agreed that there is a limit to the speed with which any job can be undertaken. It is our experience, that as far as contractors go, and I think you will agree, is that with increased work tempo they have very few accidents.

Mr. Elfstrom: Since the majority of accidents are caused by supervisory failure, do you not agree that management should see that supervisors are given adequate periods of training in safety and be held responsible for safe production.

Supervisors are part of management, but I think that you can say the top management should see that the lower echelon supervisors are given adequate safety training, and authority to carry out their safety procedure, and if they do that they will be able to have a safe plan and I think that they should be held responsible. I think that you can compare accident rates against overall efficiency of a department, — a low accident rate indicates high efficiency, and vice versa.

Mr. Francis: You brought it out that there are financial losses of accidents and unsafe practices. Should you not emphasize the human aspect, that no unsafe practice can be allowed to endanger the life or limb of any human being? When we are dealing with management, we have to justify our efforts financially, economically. In other words, industry is run primarily to make a profit. Any effort of industry has to have its profit motive. We can show that accident prevention is justified from the economical angle. However, the enthusiasm, the interest, the incentive for working in accident prevention is not a thing of the head or the pocket book. It is a thing of the heart. There is no safety man of any experience who does not get his incentive, his drive, from the distress and suffering from the humanitarian aspect of the job. If there were no financial loss there would still be an accident effort based wholly and purely on the humanitarian instinct.

Mr. McEwen: The question is as follows: "You did not mention the work that a safety committee could do in making periodic tours of the premises. Such a committee can point out faults and unsafe practices that may have been overlooked. Would you care to comment?" I think normally, certainly in the larger plants, that they do have safety committees that are probably headed up by their safety engineer or the man in charge of their safety, the committees being made up of representatives, all different types of employees, the management's representative, the foremen's representative, and one or more workmen's representatives, and I believe it is the custom that they make regular tours of the plant and that they endeavour to look for operations that are not carried out in a proper manner, and they can be of great value in picking up things that are not quite safe and making recommendations to management that changes be made.

Mr. Francis: I would like to point out that in British Columbia it is mandatory for every operation having more than 20 workmen, to have a joint labour-management safety committee, half of them picked by labour, half by management. The experience has shown the safety committee to be one of the most effective tools in the accident prevention game.

Mr. Francis: "What incentive is there for management to invest in safety education for labour that often quits a job in the first few days of service?". First of all, I wonder if management in that case is using the best means of selecting its help. Secondly, if it is, and if it is taking labour that is transient labour in the construction industries, I think that all the construction companies then should agree that if they do a little bit of education, even if the working population is floating around from job to job, the tendency will be to raise the knowledge and ability of those men, increase their knowledge of safety, and increase their desire to do something about it.

Mr. McRae: "Our Company makes up an injured man's pay while on compensation. This does not appear to have increased our frequency rate. What is the experience in other industries?".

Mr. Francis: There has been a tendency in many companies and organizations varying with the term of service that a man has had, to pay his full wages, but in many cases this introduces a tendency to stay off work unnecessarily.

Mr. McRae: "We pay to each employee one day's pay for a year of work at each plant without a lost time accident. Managers and assistant managers are excluded. Does this panel think this correct? In order to get hazardous conditions corrected without taking up time in safety meetings, we have books at departmental locations. Other plants might wish to adopt this procedure."

Mr. Biker: I would like to say, my experience is that U.S. Steel, in their plants which I happened to visit a few years ago, had incentive plans along that line and they dropped them for the reason that the employees all felt after the newness of it had worn off that it was part of wages.

Mr. Elfstrom: "For the engineer designing a plant to be made responsible for all safety features of erecting, operation and maintenance, is a very large assignment. Where is he to get all the necessary information to complete the assignment?" My comment on that would be that you never have one engineer who is doing the complete job of engineering of a plant. You have a specialist in each line, and the world is just full of people who want to give some advice. All you have to do is ask somebody some questions.

Mr. McEwen: The question is: "Mr. McEwen said not enough attention is given to safety when construction is being planned, e.g. a bridge. How can that be changed?" I don't know that I know the answer to that question directly, but I believe it is through such panels as this and educating engineers in the same way that management and supervisory staff and the workman should be educated, to watch the safety hazards and try and design their plants, bridges, whatever it may be, so that there is a minimum hazard involved in the construction period.

Chairman: We have come now to our closure, and it is going to be very brief. We are going to ask each member of the panel, starting with you, if we may, to give in a few minutes what he considers the point he wants specially to have you take home for action, the high point as he sees it.

Mr. Francis: I would like to say that accidents are a social evil, a social waste. You are a member of society. You have a responsibility to recognize that there is something wrong and to do your part as an individual.

Mr. McEwen: There does seem to be a feeling that it is management's responsibility to see that proper

provisions are taken to prevent accidents. I think management in their delegation of responsibility to engineers who design their plants, also delegate that responsibility to them, and I do think that the designing engineer should take full advantage of the safety engineers, or safety men's training for the investigation of accidents, find out what causes them and so on, in designing their plants.

Mr. Biker: From the questions, and from the words of my colleagues, I think you will all realize there is a real problem. I think it is a challenge. All I can say is, engineers, let's carry the ball.

Mr. McRae: I would just like to reiterate my previous statement, that a continuous plan of safety education will help this accident prevention campaign a great deal.

Mr. Elfstrom: I would just like to add to you who are not directly interested in safety, to make it an interest of yours and find out what your accident rate is, and see if you can't do something about it. It is management function, and you are members of management.

Chairman: The gentlemen of my panel very kindly allowed me to have the last word, and to start it I have saved one question for myself. "Would you say the housewife, with an 84-hour week, is management or labour ? Who arranges the safety of the household ?" Well, I would say that a housewife is a part of both management and labour, and she should consider herself part of the family team, but the responsibility for safety, as with other responsibilities, should rest with every member of the team. I should hope that the men or women or children would draw on every resource. If the man had had great experience out in plant, business or industry, that he would bring that into the home situation tactfully, and that it would be duly incorporated into the procedure. I would say that the woman of the household probably has the best opportunity to make a long term careful study of all the factors of the situation, especially might we say the human factors. I would like to say also, if I may, that I think that home safety as a factor in the whole safety picture has been underestimated. Not only do we know the number of accidents that occur there but the tremendous effect of what happens in the home on what happens in every other field of life. I know the gentlemen on the panel and every one of you will agree that a worker who comes from a home which is well run and from a family where there is serenity of spirit and happy family relations, is a tremendous asset, and that even if our procedures aren't all we might wish they might be, we have something to build on. I think all of us also would like you to feel that this safety problem is an all-the-way-round-the-clock proposition, and that we are really aiming for safety minded people who carry safety into every life situation. Now because industry has had the longest experience and in many ways the most resources in money, in equipment, we really do look for a great deal of help and leadership in this field.

Finally, I would like to raise one more point, and that is what is safety for. I think there is a very real association between safety and save. We talk about "Save a life — it may be your own". More important than it being your own, I think, is that it may be someone else, but that is neither here nor there. But we save to spend. And I really do feel that in our safety program that has to be a part of the motivation that we never forget. I remember well in the early days in the safety field, how our President Roosevelt—at that time Theodore Roosevelt—was a little in doubt as to whether the safety program might take away from the daring and the courage and the initiative. I think we have proved that it is not necessarily so. But just as we save to spend, so in the safety problem, to keep as safe as you can is the ordinary every day situation, in order that we may have the more to contribute to the greater causes which we all serve. √

The Real Netherlands

Many a foreigner imagines the Netherlands as a country of wide grassy meadows populated with sleek cows contentedly grazing; of fertile acres bearing costly crops; of blossoming bulb fields and orchards —all of it criss-crossed with canals and encompassed in dykes; a country of windmills and bridges, picturesque villages and quaint, old-time towns. This picture of Holland is largely true, and all these things are in fact to be seen there. But it would be quite erroneous to deduce from it that all Dutchmen are farmers and farm-hands; the fact is that statistics show only 20 per cent of Holland's 4,000,000 labour force is agricultural, while 40 per cent consists of industrial labour. Furthermore, agriculture offers little chance of absorbing additional labour in the future, and it may be that mechanization will even reduce employment capacity, while the industrial force remains steadily on the increase.

The metals group of industries is one of the most important elements in modern Netherlands industry and even in numbers of workers it heads the list. Nearly 10 per cent of the Dutch labour force is employed in it. Taking turnover value as a yardstick the group falls to second place, behind the foods, beverages and tobacco group.

Dutch official statistics divide the metals group into 11 sub-groups, of which "mechanical and structural engineering" is the largest on the basis of both number of firms and number of employees. As at June 30th, 1951, it included 727 firms. Their staffs totalled 68,000 or 25 per cent of the entire metals group. By total turnover in 1950 it stands out above shipbuilding and challenges the electrical industry for first place.

The most important mechanical and structural engineering products are the following: boilers, steam engines and steam turbines; internal combustion engines; various machinery; pumps; valves and control gear; metal structures; hoisting equipment.

Combustion Engines

The internal combustion engine industry in the Netherlands is primarily engaged in the manufacture of diesel engines. They are made in a variety of types and range of powers by 16 different firms. There is also a combine set up by four firms, which has taken up the serial construction of small high-speed stationary diesel engines of up to 25 hp.

A few firms assemble imported parts, but most of them manufacture the engine from beginning to end.

Five large mechanical engineering firms have now formed a combine to take up the manufacture of gas turbines.

Of recent years, the industry has also specialized in the manufacture of light auxiliary petrol engines for bicycles.

The DEFENCE CONSTRUCTION PROGRAM

by

R. G. Johnson,

President,
Defence Construction (1951) Ltd.,
Ottawa.

An address delivered at the 66th Annual General and Professional Meeting of The Engineering Institute of Canada, at Vancouver, B.C., May 7, 1952.

The author discusses the role of Defence Construction (1951) Ltd. in Canada's defence construction program and outlines some of the special problems encountered in the design work for such projects as a 120-foot span pre-cast, concrete arch hangar and foundations which must rest on perma-frost in the far North.

This Crown company not only lets the contracts but also is responsible for the employment of engineers and architects, on a consulting basis, for the design of buildings and facilities required by the Department of National Defence. At no previous time, the author declares, has the part played by the Canadian engineering profession in the engineering design of such a program been so large.

What is Defence Construction (1951) Ltd. ? It is a Crown company and a branch of the Department of Defence Production. It is the civilian agency established for the letting of defence construction contracts, in keeping with the wartime policy, illustrated in the Dept. of Munitions and Supply, that purchasing for the Dept. of National Defence should be through a civilian agency.

D.C.L. is therefore the successor to the old Defence Projects Construction Branch of Munitions and Supply. Not only is D.C.L. responsible for the letting of construction contracts, but also for the employment of engineers and architects, on a consulting basis, for the design of buildings and facilities required by the Dept. of National Defence. While the consulting contract is arranged by D.C.L., the physical requirements are laid down by the Dept. of National Defence.

Supervision of construction in the field is carried out for D.C.L. by Central Mortgage and Housing Corporation under a management agreement. When the present defence construction program was launched, the armed services were extremely short of supervisory personnel, while C.M. & H.C. had a field organization at practically all of the main sites where the program was to be built. In spite of the general thinness of the construction industry arising out of the large volume of all types of construction, that field organization has been considerably strengthened. In addition, it is the policy to retain consultants on buildings involving special construction features where a knowledge of design is considered of particular importance.

D.C.L. also uses the facilities of the regional offices of C.M. & H.C. at Vancouver, Winnipeg, Toronto, Montreal and Halifax for calling tenders. This assistance has greatly expedited the processing of such a large volume of tenders.

D.C.L. does not award contracts for airport runways, which come under the Dept. of Transport, nor for married quarters which come under C.M. & H.C. Nor does D.C.L. award contracts for buildings which are the subject of capital assistance to private enterprise for the production of defence requirements such as aircraft and guns.

The company has followed a policy of calling public, competitive, firm price tenders on all projects. The only exceptions have been a few secret jobs and one or two alteration-type projects that had to proceed as plans and specifications were being developed. At our request, tenders have been singularly free of escalator clauses.

Turning now to the nature of the direct defence construction program, it can perhaps be best described as our effort to achieve two main objectives: first, the provision of the facilities needed to fit Canada for her part in North American defence strategy; and second, to supplement our highly specialized defence production program. This production program falls into three main categories: aircraft, electronic equipment and shipbuilding. Thus our construction program emphasizes the building up of our airfields, our radar stations and our coastal defence installations.

How large is the defence construction program ? It is a three-year program which started April 1st, 1951. In the fiscal year ended March 31, 1952, D.C.L. awarded over $206,000,000 in contracts. I would expect that D.C.L. might be called upon to launch something in the order of another $200,000,000 in new projects in this fiscal year, 1952-53, ending next March. The company paid out in progress payments in 1951-52. over $113,000,000 and I would anticipate that the company might expend nearly $200,000,000 in 1952-53. This compares with an estimated expenditure for all new construction in 1952 of $2.9 billion, thus representing approximately 7 per cent. However, the real impact of the defence construction program is better understood when one realizes that, ordinarily, engineering construction represents somewhat under 50 per cent of total volume, housing about one-third, and other types of building construction the balance. Since defence construction is largely in buildings, the heavy impact on the part of the construction industry largely devoted to buildings is obvious.

There is every indication that

1952 will be the peak year for the program with respect to defence construction actually put in place. In this D.C.L. has been greatly assisted by the fact that many tenders were called throughout the winter months, making possible an early spring start.

While such a program calls for an expenditure approximately double that of 1951, it involves only approximately 40 per cent greater expenditure than our current monthly rate, which has kept up remarkably well during the winter months, now averaging over $12,000,000. Expenditures are now approximately 50 per cent of awards and we are now reaching the stage of an increasing number of "take-overs" of completed buildings. Projects to a total value of over $60,000,000 have been completed.

Some idea of the regional impact of the program can be gained from the fact that the awards to date are about 12 per cent of the total in the Maritimes; slightly over 50 per cent in central Canada; over 27 per cent on the Prairies and about 7 per cent in British Columbia. A number have not been localized statistically. All these figures deal with contracts let through D.C.L., which do not include married quarters let through Central Mortgage & Housing Corporation, nor airport development, let through the Dept. of Transport. Work for the Dept. of National Defence let through D.C.L. represents something less than 80 per cent of the total, the balance being through these other agencies.

In the development of this program there have been many difficulties to overcome. The completion of building plans and specifications, the development of site plans, the location of sewer and water lines and related engineering problems all take time. In the anxiety to speed the program, some of us may have not taken sufficient account of the engineering problems associated with such a large program launched so rapidly, nor of the practical problems of squeezing so much construction so quickly into a well-established stream of construction activity that was already at peak levels. From this stream there had to be some diversion for defence projects. The establishment of this diversion took a little time. But all things considered, I feel it has been accomplished fairly rapidly and that the defence construction program now has its established place in the country's over-all construction activity.

In terms of labour, the total field force has been currently estimated at something over 11,000 and something over 15,000 may be required to carry out the increased program. At peak periods the requirements would be greater. This is not large in terms of the total labour-construction force, estimated at 350,000, but we may be involved in local shortages.

In terms of steel, the company's average monthly requirement was something over 3,000 tons for reinforcing bars in 1951 and might average something over 4,000 tons in 1952. In terms of structural steel, D.C.L.'s requirement was over 1,000 tons per month in 1951 and might be something in the neighbourhood of 1,500 tons in 1952. In the field of steel, therefore, the impact of the direct defence construction program is substantial, as its requirements are large in relation to the dollar volume. This is, of course, inevitable in view of the nature of the buildings being constructed.

The company's requirements in the field of pipe, mechanical equipment for heating plants, sewer and water systems, and electrical equipment will be substantial this year. We will count heavily on the assistance of manufacturers and suppliers in continuing co-operation to meet these priority defence requirements.

D.C.L. has done its best to improve on steel deliveries, both reinforcing and structural, by calling tenders for these materials separately for all but very small tonnages. In this way an effort is being made to phase the work so that steel will be available on the job at the time required. Naturally there can be no guarantee that this will be the result in every case, but I think there is general agreement that the system under which the company is operating represents a considerable advance. The same purchasing policy is being applied to pipe, boilers, hangar doors and other special items in the program.

The defence construction program would not be where it stands today without the energy, enthusiasm and co-operation D.C.L. has had from the engineering profession, not only as private consultants, but also in the offices of the many manufacturers who are participating in the program, in the offices of the armed services, in research laboratories and in the myriad places where the engineer emerges with the solution to the problem of the hour —even in contractors' offices!

At no previous time has the part played by the Canadian profession in the engineering design of such a program been so large. In the early stages of the program, more than a year ago, much of the design was carried out by consultants in Ontario and Quebec because of the proximity to defence headquarters and the necessity for close liaison in the design of standard buildings whose construction was to be started as quickly as possible and repeated almost from coast to coast. As the program has got under way, however, every effort has been made to employ consultants in all regions of the country. In particular, advantage is being taken of local consultants with respect to matters which are influenced by local conditions.

A notable example of the more interesting engineering features of the program is the development of foundation design for perma-frost in the far North. A new method of supporting structures on special footings, resting on permanently frozen ground, has been developed. Then there was the development of shop-and-field methods for going into the far North and building permanent structures and getting out at the end of the very short summer season. This involved as much shop fabrication as possible, to shorten erection time on the site.

D.C.L. is building a number of hangars of unusual design. The 160-foot span concrete arch hangar has a poured-in-place, thin-shelled arch supported on concrete ribs. A prestressing system is used to take the thrust of the arch at ground level. The arch is poured on travelling plywood forms. The same hangar is also being standardized in steel with I-Beam arches of unusual and economic design.

The company has now developed a type of structure previously unknown in Canada, called a "Cantilever Hangar". It features a central concrete structure, which constitutes the workshop section, on each side of which there projects a 120-foot steel cantilever. This design provides the maximum in flexibility because building designers have an almost hopeless task trying to keep ahead of aircraft designs. It is hoped that this will keep ahead of anybody's airplane.

D.C.L. also has a 120-foot span pre-cast, concrete arch hangar, which is the first of its kind in Canada. It has been tested at Comox, B.C., and not found wanting.

The company is constructing a special gun-proof range, designed to test behaviour of gun barrels, shells and projectiles by means of electronic-measuring devices.

For a building in Southern Alberta, D.C.L. recently conducted an inter-

esting experiment. The company described what it wanted in general terms and called for tenders on a design-and-build basis. Several bids were received and the project was awarded. This was a simple building and I do not suggest that we will be making a practice of this procedure.

In the construction of our radar program, Canadian engineers have developed new features which have since been adopted in the United States. At Namao, Alberta, we are erecting the largest building in Canada featuring pre-cast concrete construction in the roof slabs and beams.

At Cobourg, Ont., the company is building what I believe is the largest structure in Canada featuring pre-stressed concrete construction.

I think it is rather interesting that government agencies which are frequently looked on as rather old and stodgy are, on the advice of their engineers, going ahead and pioneering these new and economic designs. I am sure it must be something of an inspiration to the engineers who are participating in this work.

While we hear much about our industries pushing into the frontiers of our country, it may be of interest that defence construction is there too. The company has learned of many of the peculiar problems of building design in the north country. For example, the vapor barriers which will suffice in southern Canada, have been considerably improved for the North. The North-West Highway System, better known as the Alaskan Highway, has been maintained for full winter, as well as summer, operation. In this work the soil mechanic is faced with most interesting problems produced by the far North, in the control of landslides, perma-frost, river scour and the support of bridge piers.

Interesting designs have been developed for wharves to handle the complicated navy equipment required for seaward defence installations. These range from concrete crib wharves to wharves consisting of concrete cylinders supporting pre-cast concrete beams.

When one considers that these developments have nearly all taken place in a period of less than two years, one begins to appreciate the part that the Canadian engineer has played in our defence construction program. Perhaps partly through force of circumstances and partly through his own initiative and imagination, the engineer is emerging as the "keystone" of the new industrial Canada. It is an Engineering Age and Canadian engineers have, and are, showing themselves equal to any tasks confronting them in this great growth period. This development of the Canadian engineer has largely taken place in the brief span of the first half of this 20th century. It is a record to inspire the profession to new heights and to attract the cream of Canada's youth to the engineering faculties of our universities from coast to coast.

In conclusion, I think one important fact we may be inclined to forget occasionally is that the defence construction program is for the protection of ourselves and our children—barrack blocks, garages and warehouses may not sound as glamorous as jet planes and all the paraphernalia of electronics—but they must come first to house the men and the equipment. Defence construction is therefore of top urgency.

The Canadian approach to national defence is many-sided. While we must build up our military strength and we must also develop the resources needed to sustain a long struggle, at the same time we must keep the civilian economy on an even keel. Thus it is that the development of our military strength, our very substantial capital expansion, and the maintenance and extension of essential services go hand in hand as a united program. I know that the engineering profession will continue to make the great contribution which it has been making towards this national effort. √

E.I.C. Technical Papers

The Institute maintains a fund for the separate publication of high-calibre original technical papers. Interest in such papers is limited to a relatively small audience of specialists in the subjects to which the papers relate, and it is not economically sound to publish them in the *Journal* which aims at the interest of some 14,000 engineers in all branches of the profession.

It is an obligation of the Institute to publish original works which contribute to the reference literature of the profession. The Technical Papers are distributed to the world's major engineering societies and technical libraries. Similarly it is an obligation of those engineers qualified to write these papers to submit them for possible inclusion in the literature. The publications committee invites authors to present such manuscripts for submission to qualified reviewers and publication if warranted. Written discussion will be accepted and published as supplements.

Technical papers issued to date are:—

No. 1—Flow in Conduits and Canals:—*French and Wood.* Comprises tables and diagrams for the solution of problems of flow in open and closed channels. Price $1.50

No. 2—A Revised Manning Flow Formula:—*Blench.* A discussion of the various hydraulic flow formulae in use or proposed. The author, formerly Director of Irrigation Research, Punjab, Pakistan, and now on the staff of the University of Alberta, concludes that the Manning formula, with modifications, is the best now available. Price . $1.00

No. 3—Air Entrainment by Water in Steep Open Channels:—*Priest.* A theoretical solution of a problem of interest to hydraulic engineers. Price $1.00

No. 4—Graphical Solution of Partial Differential Equations with Engineering Applications:—*Wood.* Solution by simple, almost automatic, methods, of equations arising from the study of water hammer phenomena, impact, and other common engineering problems. This paper will be of particular value to hydraulic engineers and structural and machine designers. Price $3.00

No. 5—Economy in Rigid Frames:—*Monti.* Charts and diagrams to facilitate rapid preliminary design of the common types of rigid frames, eliminating the cut-and-try methods previously necessary before a final analysis could be attempted. This paper belongs in the library of every structural designer. Price $1.00

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N.B.—Remittance with order please, payable at par in Montreal.

FROM MONTH TO MONTH

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

Col. L. F. Grant, New Chairman of ECPD

Colonel L. F. Grant, M.E.I.C., of Kingston and Toronto, Ont., has been elected chairman of the Engineers' Council for Professional Development. This is a great tribute to Colonel Grant and to Canada. The Engineering Institute of Canada is the only member of the Council outside of the United States. The U.S. members are American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society for Engineering Education, American Institute of Chemical Engineers and National Council of State Boards of Engineering Examiners.

L. F. Grant, M.E.I.C.

Colonel Grant is a past president of the Engineering Institute and is presently serving as field secretary at Toronto. For many years he was an associate professor of engineering at the Royal Military College, Kingston, and held a similar post at Queen's University, following his retirement from the Canadian Army in 1944.

During World War I he served overseas as a captain and major with the 5th Battalion, Canadian Railway troops. In World War II he served as general staff officer, Military District No. 3, with headquarters at Kingston, with the rank of lieutenant colonel.

President Stirling Visits Branches

President John B. Stirling has established his itinerary of branch visits for the months of October, November and December. While the program will be well underway by the time this item appears in print, the complete program is included as a matter of record. It is expected the president will visit the branches east of Montreal in the new year.

Kingston, Tuesday, Oct. 7; Ottawa, Thursday, Oct. 9; Belleville, Tuesday, Oct. 14; Port Hope, Wednesday, Oct. 15; Hamilton, Thursday, Oct. 16; Niagara Falls, Friday, Oct. 17; Kitchener, Monday, Oct. 20; London, Tuesday, Oct. 21; Sarnia, Wednesday, Oct. 22; Windsor, Thursday, Oct. 23; Peterborough, Friday, Oct. 24.

Cornwall, Monday, Nov. 3; Toronto, Tuesday, Nov. 4; Kapuskasing, Thursday, Nov. 6; North Bay, Friday, Nov. 7 (Temiskaming); Sudbury, Monday, Nov. 10; Sault Ste. Marie, Tuesday, Nov. 11; Lakehead, Wednesday, Nov. 12, or Thursday, Nov. 13; Winnipeg, Friday, Nov. 14, or Saturday, Nov. 15; Regina, Monday, Nov. 17; Calgary, Wednesday, Nov. 19; Lethbridge, Thursday, Nov. 20; Trail, Friday, Nov. 21; Penticton, Monday, Nov. 24; Victoria, Wednesday, Nov. 26; Vancouver, Nov. 27-29; Prince Rupert, Monday, Dec. 1; Edmonton, Dec. 4-6; Saskatoon, Monday, Dec. 8; Prince Albert, Wednesday, Dec. 9.

Cover Picture

Lathe in operation turning rotor for a hydro-electric driven generator, at a large Peterborough engineering works.—*Photo by Malak, Ottawa, courtesy Canadian General Electric Company Limited.*

Maritime Professional Meeting

September 1952, St. Andrews, N.B.

As at the annual meeting in Vancouver last May, the weatherman provided exceptionally pleasant weather conditions for the recent Maritime Professional Meeting at St. Andrews, N.B. last month.

The Council of the Engineering Institute held a well-attended meeting on the afternoon of Wednesday, September 10th. With the President in the chair, a number of items of important business were considered and some valuable discussions ensued.

The Council meeting was followed by an informal dinner and in the evening the President and Mrs. Stirling held a reception in the lounge of the Algonquin Hotel.

A record attendance turned out to enjoy the excellent program prepared by the Committee in charge of arrangements under the general chairman, A. G. Watt of Saint John, N.B. As in previous years, the technical program consisted of two papers on each of the two mornings while the afternoons and evenings were devoted to recreational and social events.

Capt. H. Ross Smyth, M.B.E., head of the Radar Development Section of the National Research Council presented the first paper on Thursday morning on "Recent Electronic Aids to Navigation".

C. E. Weyman, M.E.I.C., of Fredericton acted as chairman for the meeting. Capt. Smyth described the adaptation of radar principles in designing equipment suitable for the use of small fishing and other coastal craft to assist them in navigating their vessels in and out of port in bad weather. A practical demonstration was afforded later the same day when members had the opportunity to view the screen of the radar equipment on M.V. *Grand Manan*.

The second paper dealt with the "Power Potential of the Saint John River" and was presented by R. E. Tweeddale, M.E.I.C., Development Engineer, New Brunswick Power Commission, Saint John, while Norman B. Eagles, M.E.I.C., of Moncton occupied the chair. Mr. Tweeddale outlined the potential of the Saint John River as a source of hydro-electric power and showed by means of charts, the result of the investigations carried out under the auspices of the International Joint Commission. This matter was referred to that body by virtue of the fact that the State of Maine, and the Provinces of Quebec and New Brunswick will all be affected by the development of power sites on this river. Mr. Tweeddale indicated the locations of the proposed storage areas and power developments along the course of the river and the extent of storage and power obtainable in each instance. It is hoped that the full text of this paper will be available later for publication in *The Engineering Journal*.

At the conclusion of Mr. Tweeddale's paper, Mr. John Reed, chairman of the Saint John Branch of the E.I.C., presided at lunch. On this occasion a welcome was extended to the members and guests by Mayor F. Keay of St. Andrews. Dr. E. O. Turner, dean of engineering at the University of New Brunswick, then addressed the gathering as the guest speaker for the luncheon, on the responsibility of the undergraduate engineer. K. J. Marshall, chairman of the Cape Breton Branch, thanked the speaker. The principal attraction on the after-

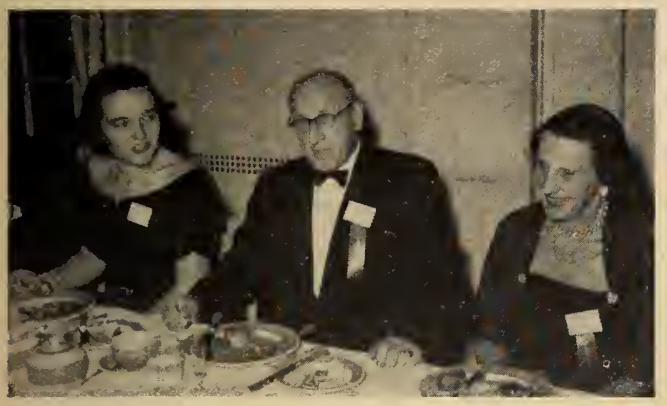
Top left. Mr. J. K. Jamieson, director of Imperial Oil Limited, speaking at the Thursday dinner.

Centre. President J. B. Stirling (standing) and R. M. Richardson, president of the Dominion Council.

Top right. John Fisher, guest speaker at the Friday dinner, with D. O. Turnbull (right) convention joint chairman and president of the Association of Professional Engineers of New Brunswick.

Lower left. Some of the head table guests at the luncheon on Thursday, left to right: A. G. Watt; Mayor Fraser Keay; John Reed, chairman; Dean E. O. Turner, the speaker; H. A. Marshall; D. J. Brewer; N. B. Eagles, and R. Lloyd Parsons.

Lower right. Among head table guests at the Thursday dinner were, left to right: L. J. Archibald; Mrs. M. Dwyer; J. W. MacDonald; Mrs. Ira P. Macnab; J. K. Jamieson, the speaker; Dr. D. J. MacNeil, the chairman.



Above. Left to right: Mrs. J. A. Flood, John Reed, Maritime Meeting joint chairman; and Mrs. T. C. Higginson, at the dinner Friday night.

Top right: Ladies' morning coffee gathering.

Lower right. Two very hard working members of the Committee, T. C. Higginson (left), chairman finance and registration; and A. G. Watt, general chairman.

noon program was a cruise on the M.V. *Grand Manan* up the St. Croix River and back around the outside of Navy Island to St. Andrew's Harbour. A capacity crowd took advantage of this opportunity and Mr. Don Turnbull of Saint John drew attention to the various points of geographic and historic interest along the route.

Dr. D. J. MacNeil, president of the Association in Nova Scotia and a vice-president of the Institute, acted as chairman of the banquet held in the Algonquin, the same evening. The guest speaker on this occasion was Mr. J. K. Jamieson, director, Imperial Oil Ltd. Mr. Jamieson described the rapid growth of oil pipe lines throughout Canada in recent years to keep pace with the development of our primary oil resources and the expanding refining capacity to meet the ever growing demand for petroleum products. Mr. Jamieson concluded his talk with the showing of a very interesting film, illustrating the construction of the major project, the pipe line from Edmonton to Lake Superior and the arrival of one of his company's new tankers loaded with Alberta crude oil at their Sarnia refinery. Following Mr. Jamieson's talk, a popular film was shown in the Casino, adjoining the hotel and the evening's program was concluded with a most enjoyable lobster buffet supper.

On Friday morning, the technical papers were continued, the first speaker being Herman J. Kropper, chief of Planning and Reports Branch, New England Division, Corps of Engineers, U.S. Army. G. Frank Bennett of Halifax acted as chairman.

Mr. Kropper spoke on the "Passamaquaddy Tidal Power Project" and pointed out that while there were no foreseeable engineering problems which might hinder the development of the project, no comprehensive study had been made to date.

Golf Results

1st low gross	E. O. Turner
2nd low gross	J. G. Fitzpatrick
1st low net	Pat Fleming
2nd low net	M. W. Black
Low gross—1st nine	K. Bishop
Low gross—2nd nine	T. Somerville
Hidden hole	G. Robinson
Poker hand	W. R. Godfrey
Honest golfer	C. E. Weyman

Ladies' Golf Tournament

1st low gross	Mrs. E. O. Turner
2nd low gross	Mrs. S. Black
Low score—15th hole	Mrs. V. A. Ainsworth
High score—3rd hole	Mrs. G. F. Bennett

Ladies' Bridge Tournament

1st	Mrs. D. Fowler
2nd	Mrs. A. S. MacDonald

Ladies' Putting Tournament

1st	Mrs. Turner
2nd	Mrs. Ainsworth

Two ladies had a hole-in-one twice

Mrs. A. G. Watt Mrs. Price

Such a study, he went on to point out, was essential before its feasibility could be accurately determined. The present general plan provided for the use of Passamaquoddy Bay as a high level reservoir and of Cobscook Bay as a low level discharge basin. Several dams would have to be constructed to enclose these basins, together with control gates and power houses. Before construction costs can be estimated with reasonable accuracy, the foundation conditions for all of these structures would have to be determined. Furthermore the available power capacity as well as its characteristics would require to be worked out carefully. Mr. Kropper intimated that, quite conceivably, the cost of tidal power would prove to be so high under present day conditions, that its development would be uneconomical and impractical as compared with other available power sources.

The final paper of the meeting was presented by O. Nelson Mann of the Nova Scotia Department of Trade and Industry. R. B. Smith, Secretary-Treasurer of the P.E.I. Branch of the Institute, was in the chair and Mr. Mann's subject was "Business Activities Down East". In his talk he described the development of various industries in Nova Scotia during recent years and emphasized how advantage had been taken of modern scientific discoveries and developments to exploit new markets for the products and resources of the province.

At the luncheon which followed, J. B. Stirling of Montreal, President of The Engineering Institute of Canada addressed the meeting on the status of engineering as a profession. He pointed out that this was to a considerable extent dependent on the standing of its members, collectively, in the various communities where they lived and worked. Mr. Stirling decried the tendency on the part of some members of the profession to belittle the part played by engineers in civic and political affairs. He then went on to emphasize the activities of many of our Canadian engineers in government and other fields. He pointed with justifiable pride to the fact that two of our Federal ministers were engineers. Many examples were cited of others who were taking a leading part in the public service and through their activities had done much to enhance the status of the profession in the eyes of the public.

J. W. MacDonald, chairman of the Halifax Branch E.I.C., presided at the luncheon and R. M. Richardson of Saint John, President of Dominion Council, thanked the speaker.

After lunch a large number took part in the golf tournament arranged for the occasion while others visited near-by points of interest. The meeting climaxed with the banquet and grand ball held on the same evening. D. O. Turnbull, President of the Association of Professional Engineers of New Brunswick, presided and took obvious pleasure in having as guest speaker his old schoolmate, Mr. John Fisher, of Sackville, N.B., nationally known reporter and radio commentator. Mr. Fisher spoke in his usual dramatic fashion of Canada's resources and the part being played by Canadian engineers in their development.

Mr. Rod Richardson of Saint John was called on by the chairman to present the prizes for the golf tournament to the successful contenders. The names of the winners are shown elsewhere in this report.

Following the banquet, everyone adjourned to the Casino and the remainder of the evening was spent in dancing. This concluded the official program for the meeting although many of the members and their wives remained until the following day before taking their departure.

The Committee on Arrangements was, as mentioned previously, under the general chairmanship of A. G. Watt of Saint John, N.B. Joint chairmen under Mr. Watt were John Reed and D. O. Turnbull also of Saint John. J. A. Flood acted as general secretary with T. C. Higginson in charge of Finance and Registration. The ladies committee under the chairmanship of Mrs. John Reed did an outstanding job. In fact all arrangements were so well taken care of that special mention should be made of every individual who contributed to the organizing of this highly successful meeting. A very special feature which was in evidence at all social functions was the room known as "Muriel's". The thanks of all who attended is due to those who contributed to this hospitality which was greatly appreciated.

Nominees for Office

The report of the Nominating Committee, as accepted by Council at the meeting held on September 10th, 1952, is published herewith for the information of all corporate members as required by Sections 19 and 40 of the by-laws:

President	R. L. Dobbin	Peterborough
Vice-Presidents:		
*Zone A (Western Provinces)	I. M. Fraser	Saskatoon
*Zone B (Province of Ontario)	G. R. Henderson	Sarnia
*Zone C (Province of Quebec)	I. R. Tait	Montreal
Councillors:		
†Newfoundland Branch	Ernest Dickinson	St. John's
†Prince Edward Island Branch	G. J. Hayes	Summerside
†Halifax Branch	A. R. Harrington	Halifax
†Fredericton Branch	H. G. Hughson	Fredericton
†Saint John Branch	John Reed	Saint John
†Saguenay Branch	H. R. Fee	Arvida
†Lower St. Lawrence Branch	L. P. Dancose	Mont Joli
†St. Maurice Valley Branch	E. E. Copping	Three Rivers
†Eastern Townships Branch	G. J. Cote	Sherbrooke
§Montreal Branch	Jacques Benoit	Montreal
	E. Gray-Donald	Montreal
	F. L. Lawton	Montreal
†Ottawa Branch	Thomas Foulkes	Ottawa
†Kingston Branch	D. L. Rigsby	Kingston
†Port Hope Branch	J. M. Jordan	Cobourg
†Belleville Branch	S. Sillitoe	Belleville
‡Toronto Branch	C. D. Carruthers	Toronto
†Border Cities Branch	J. G. Hoba	Windsor
	H. D. Keil	Windsor
†London Branch	V. A. McKillop	London
†Northeastern Ontario Branch	N. C. Cowie	Iroquois Falls
†North Bay-Temiskaming Branch	A. K. Grimmer	Temiskaming
†Sudbury Branch	E. Russell Eaton	Sudbury
†Lakehead Branch	H. M. Olsson	Port Arthur
†Saskatchewan Branch	A. B. Olson	Saskatoon
†Edmonton Branch	E. L. Smith	Edmonton
†Central British Columbia Branch	M. L. Wade	Kamloops
†Kootenay Branch	E. Mason	Trail
†Vancouver Branch	J. E. Macdonald	Vancouver
†Vancouver Island Branch	T. A. J. Leach	Victoria

* One vice-president to be elected for two years.
† One councillor to be elected for two years.
‡ One councillor to be elected for three years.
§ Three councillors to be elected for three years each.

Head table at the banquet. Left to right: R. Ballester, Argentina; Carlton Proctor, U.S.A.; J. B. Stirling, chairman, Canada; Stacy May, the speaker; Luis Giannattasio, Uruguay, president of UPADI.

UPADI Meets in New Orleans

The Pan-American Federation of Engineering Societies (UPADI) held its second convention in New Orleans from August 25th to 29th. The host societies were Engineers Joint Council, U.S.A., and The Engineering Institute of Canada, with the Louisiana Engineering Society ably performing the details necessary to a successful convention through the appointment of a number of local committees.

The Engineering Institute of Canada was well represented by a delegation of five members made up of the president J. B. Stirling of Montreal, Past President James A. Vance of Woodstock, Ontario, Dean Kenneth Tupper of Toronto, Vern King of Woodstock and the general secretary.

Registration, including ladies, numbered 314 and included 14 countries: Argentina, Brazil, Canada, Chile, Columbia, Cuba, Dominican Republic, Mexico, Panama, Paraguay, Peru, Puerto Rico, United States and Uruguay.

The principal business of the Convention was the adoption of a Constitution and By-laws, which was accomplished on Wednesday, August 27. It was agreed to finance the organization through a UPADI Fund, and a budget for the coming year in the amount of $15,000 was adopted. Committees were established on administration, professional ethics, relations with other organizations and technical matters. The Convention decided to hold its next meeting in 1954 in Sao Paulo, Brazil. In that year the city will observe the 400th anniversary of its founding.

One full day was devoted to the presentation of papers on aspects of engineering education in the hemisphere. Deans of engineering schools in Canada, United States and Latin America participated in the program. The concluding feature of the convention was a group of papers on the Economic Development of Latin America.

A highlight of the Convention was

J. B. Stirling (centre) presents Canadian coat of arms to James M. Todd (right), chairman of the local committee. L. Austin Wright looks on approvingly.

The Canadian delegation. Left to right: James A. Vance, L. Austin Wright, Vern King, J. B. Stirling, Kenneth Tupper.

the presentation by Dr. Giannattasio of a bronze plaque commemorating the Second UPADI Convention in New Orleans. Carlton Proctor accepted the plaque on behalf of the Engineers Joint Council. The Engineering Institute of Canada presented plaques bearing the coat of arms of Canada to each of the delegations present.

The local committee was under the direction of James M. Todd, a past president of the American Society of Mechanical Engineers. Mr. Todd and his committee with the able support of Mrs. Todd, who headed up the women's activities, did a wonderful job for the visitors. The whole meeting was run off extremely well, even though the program was crowded, the weather hot and the distances between meetings, great. The much heralded southern hospitality was experienced in full measure. Even the weather was better than is usual for that time of year. There was no rain and the thermometer never was above 95°.

All sessions were held at Tulane University except some of the meals. Conditions at the university were excellent as the auditorium was air conditioned and more than ample in accommodation. Dean Lee H. Johnson earned the appreciation of all delegates by making these facilities available and for his great interest in the comfort and welfare of all his visitors.

The Canadian delegates had prominent parts to play in the program. J. B. Stirling presided at the banquet on the closing day and was one of a small committee that had the difficult task of selecting the date and place for the next conference. Mr. Vance is a director of UPADI and had much additional work to do because of that responsibility. Dean Tupper delivered an interesting, informative paper on Engineering Education in Canada. Three other deans spoke on the program. The general secretary was chairman of the Committee on Technical Matters.

The program included also papers on the following subjects:

Engineering Education, and the Philosophy of Engineering, contributed by Nicolas Besio Moreno of Argentina, Antonio Alves de Noronha of Brazil, Dean Gustavo R. Sterling of Havana University, Cuba, Salvador Sanlley-Gomez of the Dominican Republic, Juan V. Cabrerizo of Peru, Carlos Berta of Uruguay, Dean S. S. Steinberg of the University of Maryland, Dean L. J. Lassalle of Louisiana State University, Dean W. R. Woolrich of the University of Texas.

Participants in the technical program. Left to right: Salvador Sanlley-Gomez, Dominican Republic; Dean Lee Johnson, U.S.A.; Dean S. S. Steinberg, U.S.A.; Dean K. M. Tupper, Canada; Dean L. J. Lassalle, U.S.A.; W. R. Woolrich, U.S.A.; I. Vego, Uruguay; R. E. Ballester, Argentina; G. R. Sterling, Cuba; Carlton Proctor, U.S.A.

Engineering Aspects of Economic Development and Financing in Latin America was the subject of papers by J. Allende Posse of Argentina, F. Saturnino de Brito, filho of Brazil, Jose Pinera of Chile, Ross W. Davidson of the United States and Luis Giorgi of Uruguay.

Throughout the proceedings it was necessary to have an interpreter. There are three official languages for UPADI, Spanish, Portuguese and English. As most speakers were familiar with Spanish, it was the custom for the interpreters to translate into English through earphones for the benefit of the Americans and Canadians. Dr. Emilio J. Labrada of the University of Havana was the interpreter and did an exceptionally fine job, earning the gratitude of all, particularly the English-speaking group.

Of the 314 registered 171 were from outside the United States. From New Orleans there were 97 and from other American cities 46. Brazil won the honors with a delegation of over 80, many of whom went on to the Centennial of Engineering at Chicago and then to Canada. They visited the Headquarters of the Institute on September 22nd, where they were welcomed by the president, J. B. Stirling.

The Convention elected as its president Carlton S. Proctor, Pres. ASCE. Other officers were Manuel J. Puente (Cuba), 1st vice-president; Saturnino de Brito, filho (Brazil), 2nd vice-president; and as secretaries: S. E. Reimel (United States), Rodolfo Ballester (Argentina), Juan V. Cabrerizo (Peru), Hector Cassaigne (Mexico), J. B. Stirling (Canada). The Convention by acclamation elected Luis Giannattasio (Uruguay) Honorary President. Dr. Giannattasio is currently president of UPADI.

The program contained many pleasant diversions such as boat trips around the harbour, a barbecue dinner at the Country Club and a reception at the International House.

An exceedingly enjoyable event, not on the general program, was a reception to the Canadian delegates given at his home by the Canadian Consul and Trade Commissioner, Gerald A. Newman. This gave the visitors an opportunity to meet some New Orleans people and others in the diplomatic circles. The group was very appreciative of this kindness of Mr. and Mrs. Newman.

To Canada, UPADI's importance lies largely in the fact that through it engineers from twenty different nations come together from time to time in complete understanding and in the spirit of friendship. In these days of dividing the world into two camps, it is important to establish

and maintain good relationships between peoples. Not all the governments of the countries participating in UPADI are on the best of terms, but it is encouraging and helpful to see leading citizens of these countries come together in the friendliest way as members of a great profession. Through the engineers — through UPADI—at least a contact is maintained between all and it is possible that through that medium the relationship of the countries will be improved.

Montreal Branch Extends Co-operation with ASME

In keeping with the spirit of the co-operative agreement between the American Society of Mechanical Engineers and the Engineering Institute, the Montreal Branch of the Institute, through its mechanical section has arranged to invite all ASME members resident in the Montreal area to its meetings during the coming season.

Through the auspices of the ASME-EIC International Council, names and addresses of the ASME members have been made available and commencing with the opening of the fall program, notices of all Montreal Branch meetings are being mailed to those who are not already members of the Institute.

Brazilian Visitors

A group of Brazilian engineers and ladies, en route from the Centennial of Engineering, were photographed in front of Institute Headquarters building in Montreal recently. E.I.C. President Stirling is in centre, and Mr. F. Saturnino de Brito filho, president of the Brazilian Federation of Engineers, is on his left. In the group were: Adolfo Morales de los Rios filho, president of the Federal Council of Engineering and Architecture, Rio de Janeiro; Miss Mary Morales de los Rios; Mr. Alfredo Giglio, director of architecture of the municipal office of Sao Paulo, and Mrs. Giglio; Antonio Barreto Coutinho; Mr. and Mrs. Joao Baptista Bidart, Rio de Janeiro; Mr. and Mrs. Gerado Sampaio; Antonio de Voci, director-secretary of the Institute of Engineering, Sao Paulo; Joao Baptista de Almeida Prado; Mr. and Mrs. Maury de Freitas Juliao; Mr. and Mrs. Ari Ferreira de Souza; Mr. Raiumundo Camara; Carlos Valente; Jose Andre Telles de Mattos; Darcy Piegas Cordeiro; Augusto Ribeiro Pessoa; Walter Neumann; Luiz Carlos Mendonça; Miss Ilse das Neves; Miss Aracy Ferreira Leite; Miss Maria Luiza Barros; Heitor Robino; Celio Padua; Leonidas F. Rhormens, general secretary of the Institute of Engineering, Sao Paulo; Guilherme D. Villares; Miss G. Villares.

Fees in Pounds Sterling

At the request of the Finance Committee, Council recently ruled that the fees of members in Sterling areas be set at a specific sum in pounds Sterling. With the pound at its present low level, members in the Sterling areas have had to put up an increased amount in order to buy the correct amount of Canadian funds to pay their fees.

When Sterling was at par it took approximately £3.2s.0d. to meet the fee, but at the present level it takes about £5.10s.0d. With the pound being worth just as much as it ever was to people in the Sterling areas, it has been increasingly burdensome for them to meet the exchange rate.

Council has agreed to accept for a Corporate Member the sum of £3.10s.0d., for a Junior £2.0s.0d. and for a Student £1.0s.0d. regardless of the relationship of the pound to the dollar. This is a substantial reduction as far as the Institute is concerned, but it is felt that the overseas members, who so faithfully have maintained their membership, are entitled to this consideration.

This new rate does not apply to fees in arrears for 1951 or 1952. When the new accounts go out in January, 1953, they will be in pounds Sterling.

Members in the United Kingdom and in other Sterling areas are reminded that their fees may be paid in Sterling to the Institute's account with the Canadian Bank of Commerce, Lombard Street, London, England.

If you have changed your mailing address

Notify Institute Headquarters NOW

ECPD Stresses Action

Progress made at Twentieth Annual Meeting, Chicago, Ill., Sept. 5 and 6, 1952

by

G. A. Stetson

Editor, "Mechanical Engineering"

The Twentieth Annual Meeting of Engineers' Council for Professional Development, held at the Sheraton Hotel, Chicago, Ill., September 5 and 6, 1952, was a notable event from several points of view.

Notable Features

Change of the date of the meeting from late October to early September was made in order to take advantage of the Centennial of Engineering, held in Chicago from Sept. 3 to 13, to commemorate the one hundredth anniversary of one of ECPD's constituent organizations, the American Society of Civil Engineers.

Moreover, the meeting was the first to be held by ECPD in conjunction with another of its constituent organizations, the American Society for Engineering Education. In view of the fact that, during the past year, the Education Committee had cooperated with the Committee on Adequacy and Standards in Engineering Education in promoting the establishment of a committee in ASEE for the evaluation of engineering education, this joint meeting afforded not only opportunity to advance the progress of the new committee but also to hold a joint session with the Engineering College Administrative Council of ASEE devoted to a discussion of contemporary demands on engineering curricula.

The twentieth annual meeting was noteworthy also because of the election of L. F. Grant, past president and field secretary, The Engineering Institute of Canada, as chairman, ECPD, the first representative of E.I.C. to fill their important post of leadership in ECPD.

The meeting also marked the termination of the three-year term of service of Harry S. Rogers, as chairman of ECPD. Throughout his career as chairman, Dr. Rogers neglected no opportunity offered to him to express, in lucid and convincing language, the philosophy animating ECPD's function and programs. Not only did he make himself clear on these points to ECPD, but also to other joint organizations of the engineering societies and to the societies themselves. His concept of the nature of ECPD as an inter-society intra-professional undertaking has been clarifying and helpful. His logically reasoned and eloquently expressed views have communicated enthusiasm and clear thinking about ECPD to members of the Council and its friends. Significant as these achievements are they are overshadowed by the success which has attended his efforts to examine and re-orient the objectives and program of ECPD Committees. In phrases he has repeatedly used, he led ECPD from the "talk-about" into the "action" phases of its work, thereby getting some portions of its program "off dead centre".

Initiation of Training Program Announced

The culminating and perhaps the most important of Dr. Roger's action program and also the most noteworthy event of the twentieth annual meeting was the announcement that the program of the Training Committee, "The First Five Years of Professional Development", originally proposed two years ago at the Cleveland meeting, is to be initiated in Cincinnati, Ohio, during the coming year under exceptionally favorable conditions.

Officers Elected

At the administrative session of the Council, held on the morning of September 5, L. F. Grant was elected chairman. Other officers elected were: vice-chairman, H. T. Heald, chancellor of New York University; secretary, C. E. Davies, secretary ASME; and assistant secretary, H. H. Henline, secretary AIEE. The Executive Committee of the Council will consist of the foregoing officers and H. S. Rogers (ASCE), C. E. Lawall (AIME), Guy R. Cowing (ASME), M. D. Hooven (AIEE), E. V. Buchanan (E.I.C.), C. G. Kirkbride (AIChE), Thorndike Saville (ASEE), and C. S. Crouse (NCSBEE). Chairmen of the standing committees were elected as follows: Guidance, B. G. A. Skrotski; Education, Thorndike Saville; Training, Cornelius Wandmacher; Recognition, R. H. Barclay; Information, George A. Stetson; and Ethics, William F. Ryan. (A. C. Monteith was elected honorary chairman of the Training Committee at the Saturday session, in recognition of his leadership in formulating the program of that committee.)

Representatives of ASME on ECPD are: William F. Ryan, vice-president, Stone and Webster Engineering, Boston, Mass., whose first term expired in 1952; A. C. Monteith, vice-president in charge of engineering and research, Westinghouse Electric Corporation, Pittsburgh, Pa., whose first term expires in 1953; and Guy R. Cowing, president and director, General Motors Institute, Flint, Mich., whose second term expires in 1954. Mr. Ryan has been appointed an ASME representative for a second term of three years.

A budget of estimated income and expenditures for 1952-1953 of $16,450 was adopted. Of this income $10,050 comes in the form of grants from the participating societies. The ASME grant, which is based on its dues income as of Sept. 30, 1951, is $2,045.

It was announced that the twenty-first annual meeting of ECPD will be held at the Statler Hotel, New York, N.Y., Oct. 30-31, 1953.

Luncheon with ASEE

At the luncheon on Friday, held jointly with ASEE, W. R. Woolrich, president ASEE, presided. The address was delivered by John Millett, director, Commission on

Financing Higher Education, Columbia University. Dr. Millett said that while the financing of engineering education had not been a very serious problem in the past, it would become increasingly difficult to provide funds in the future.

Session on Curricula

The session on Friday afternoon was held jointly with the Engineering College Administrative Council of ASEE and ECPD. Under the chairmanship of J. H. Lampe, dean of engineering, North Carolina State College, an ECPD-ECAC Panel had been organized to discuss the topic "1920-1950; What Are Contemporary Demands on Engineering Curricula?" Taking part in the panel were: William L. Everitt, dean of engineering, University of Illinois, speaking for electrical engineering; H. E. Wessman, dean of engineering, University of Washington, on civil engineering; Neil P. Bailey, head, mechanical engineering department, Rensselaer Polytechnic Institute, on mechanical engineering; George G. Brown, dean of engineering, University of Michigan, on chemical engineering; and Curtis L. Wilson, Missouri School of Mines and Metallurgy, on mining and metallurgical engineering.

Dinner Program

The annual dinner at the Furniture Club of America, was held jointly with ASEE on Friday evening immediately following a reception. Col. L. F.Grant, vice-chairman, ECPD, presided. Harry S. Rogers, chairman ECPD, presented the substance of his annual report under the title, "Translating Programs into Action".

E. G. Bailey Addresses Luncheon

In the dining room of the Western Society of Engineers, with Harry S. Rogers, presiding, E. G. Bailey, past-president ASME, chairman of the board, Bailey Meter Company, delivered the luncheon address. Mr. Bailey answered in positive terms the question which served as the title of his talk, "Can Engineering Graduates Man a Company?" They were doing it very creditably in many cases, he said, and he posed another question, "How can each of us study the many cases at hand and draw some helpful conclusions regarding college curricula, selection of graduates, training, promotion, and organization of engineers for the best interests of our industrial economy?" He quoted some data on the ratio of engineers to employees in certain industrial establishments and stated that a typical company, which he had taken as an example, was not luring enough engineers. "In my opinion", he said, "a company in this kind of business should have about 80 per cent of its executives of engineering training". He urged that engineering graduates be taken on "every year whether business is good or bad. One of the mistakes which many companies have made is to take on fewer graduates when times are a little slack . . . We all short-changed the engineering graduates during the depression of the thirties, and then we needed them very much during the war. In 1949 all of the available engineers were not given proper jobs, and a shortage is being experienced today."

In Mr. Bailey's opinion, "hiring the proper quota of new graduates is not enough. They should be enrolled in proper training courses and given every opportunity to learn the business and develop into positions of responsibility and leadership". In closing, Mr. Bailey called for a study of factual data of successful companies for the benefit of others. "The engineering profession should present to the top executives of American industry", he asserted, "illustrations and factual data relating to the successful use of engineers in such a manner that all will strive to improve their present methods for selecting, training, and advancing engineering graduates within their respective companies."

Report of Training Committee

Morning and afternoon sessions of ECPD on Saturday were held in the auditorium of the Western Society of Engineers for the purpose of presenting the reports of the several committees and of the representatives of the constituent societies. All of these reports are available in the Twentieth Annual Report of ECPD and are summarized in the report of the chairman.

Great interest was aroused by the report of the Training Committee, A. C. Monteith, chairman. Two years ago at the Cleveland meeting Mr. Monteith and members of his committee presented a comprehensive and challenging report on a study of the needs and opportunities for the continued education and professional development of young engineers in the communities in which they would spend the first five years after graduation. A program was proposed at that time which required financial backing, intelligent leadership, and the cooperation of industries, educational institutions, engineering societies, and other community groups wherever it should be put into effect. For two years the committee had attempted to uncover a community where the program could be introduced on a pilot-plant basis, a competent person to administer the program, and funds to cover essential expense involved. Shortly before this year's meeting in Chicago, this combination of factors was found at Cincinnati, Ohio, and the pilot-plant operation of the program will be introduced there this fall. Heading the venture in Cincinnati will be Prof. Cornelius Wandmacher, head of the civil engineering department at the University of Cincinnati; who has been closely associated with ECPD and the activities of the Training Committee. He is the incoming chairman of the Training Committee and thus can personally correlate the work of the Committee with the development of the program at Cincinnati. He has the backing of the University and the engineering societies, and industries of Cincinnati.

In closing the presentation of the discussion offered by members of the panel, Mr. Monteith reminded members of the panel that the program developed by the Training Committee "is not worth a nickel if the individual is not willing and able to take advantage of the opportunity offered". There was a lot of lip service on the part of industry in the matter of training of its young employees. The ECPD program offered industry a challenge to play its part. In concluding his remarks he reiterated a statement he frequently quoted: "Education is a journey, not a destination."

Future Annual Meetings

ANNUAL MEETING, 1953 . . .

Nova Scotian Hotel, Halifax, N.S., May 20-22, 1953

ANNUAL MEETING, 1954 . . .

Chateau Frontenac, Quebec, Que., May 12-14, 1954

Prominent E.I.C. Member Receives Hoover Medal

Right Honourable C. D. Howe addresses the Centennial of Engineering in accepting this outstanding award

A feature of the recent Centennial of Engineering held at Chicago was the presentation of two outstanding engineering awards. One was the Hoover Medal, presented to the Rt. Hon. C. D. Howe, Hon.M.E.I.C., Canada's Minister of Trade and Commerce, and the other was the John Fritz Medal, awarded to Benjamin Franklin Fairless, Chairman of the Board of the United States Steel Corporation.

In receiving their medals, these gentlemen made excellent speeches. On the same occasion Herbert Hoover, once President of the United States, also spoke to excellent effect. It is proposed to publish all these speeches in *The Engineering Journal*, as they are of real interest to engineers. The first one appears in this issue.—Ed.

Mr. Chairman and Gentlemen:

My first words must be of appreciation for the great honour the engineers of America, through their Board of Awards, have done me in proposing my name for the 1952 Hoover Medal Award, one of the highest honours that can be bestowed on any engineer. I am deeply moved by this splendid token of your regard and generosity.

I am also keenly aware of the special distinction associated with this first occasion on which the Hoover Medal is being awarded to a citizen of another country. I accept this award as a tribute to Canada, and as a gesture of friendship to the engineers who have done so much to build a great nation on the northern half of this continent.

As I listened to Eugene Holman, I felt somewhat as did a friend of mine who was being introduced in a relatively unrestrained manner by the chairman. When he got up to speak, he said, "I have been so impressed by the remarks of the chairman that I can hardly wait to hear what I am going to say!" However, as Mr. Holman has said, I *have* spent the past seventeen years as a Cabinet Minister, in the active arena of Canadian political life, and accordingly have learned not to take *too* seriously all the things that are said about me. But I confess that I found it relatively easy to listen to Mr. Holman's fluent encomium, and without accepting literally all his propositions, I am conscious of the depth of goodwill behind his words.

This occasion would be a pleasant one to me under any circumstances, but there is an added element of satisfaction in having this function a central feature of the centennial celebrations which commemorate the birth of the first civilian engineering society in America. It has been my privilege to be a member of the American Society of Civil Engineers for some forty years, and this great gathering has given me the opportunity of seeing and greeting many friends and colleagues with whom I have enjoyed most pleasant associations over the years.

The Hoover Medal, I understand, was founded in 1929 by this group of American engineering societies to emphasize the importance of non-technical public service by engineers. I would be less than human if I did not take unusual pride in having my name added to the list of 13 eminent engineers who, over the past twenty-four years, have been awarded this medal. It is a group that anyone must feel flattered in joining. A catalogue of their accumulated contributions to "the well-being of mankind" is an inspiring and impressive record of distinguished service.

I feel fortunate in being able to count most of the former recipients as personal friends, and I know they will wish me to restate our great admiration and regard for Past-President Hoover, whose name the medal bears, and who graciously accepted the first award. I am sure we all wish to join in extending to him our very best wishes for continuing good health and happiness. We are very glad indeed that he is with us in person this afternoon.

On an occasion like this, in the midst of centennial celebrations, our minds are inclined to rove back over the years of our own professional experiences, and I am sure my contemporaries feel, as I do, that we have observed, and taken an active part in, the most interesting fifty years of a century of outstanding scientific progress. We have seen a succession of amazing scientific discoveries developed and applied by our professional colleagues. During the same time, we have watched our profession expand its fields of interest and responsibility from the more narrow confines of technical skills and professional specialties to those broad areas concerned with management, high policy, and public affairs.

These trends in our professional life have been paralleled by, and may even be a result of, the fundamental changes that have taken place in attitudes about national and international affairs on the North American continent. In 1900, the United States was just emerging from a period of unrivaled material growth and development, which had brought within the reach of enterprising men a prosperity that could not be duplicated elsewhere. The general outlook of most of us was that of the vigorous and successful pioneer, who was still busy developing his own business, and providing for his own financial security. We assumed—quite understandably—that our destiny depended upon our own individual efforts, and little else. Small wonder that fifty years ago there was widespread support for the idea that personal industry and prudence were enough to guarantee security, individually and nationally.

There was a logical desire to be left alone to develop one's own life and fortune, amidst the abundance of natural wealth that lay at hand. That appeared to be the road to both peace and prosperity. But we have all, I think, been forced to the conclusion, by the harsh realities of our times, that neither men nor nations can afford to remain unconcerned about the destiny of other men, or other nations.

We, as engineers, by our technological achievements took a prominent, if unconscious, part in bringing about this change of attitude. It was the application of our technology that made the world smaller and more interdependent. It seems to me that, in turn, we must and should take an active part in the attempt to solve the problems we have helped to create.

A century ago, it was possible for a nation to overlook great inequalities within its own borders. For the most part, such inequalities were regarded as inevitable, even though unfortunate. Today, at least in developed nations, we no longer pass by on the other side when confronted by regional calamities, depressed areas, or impoverished groups. It has become a cardinal principle of our national life to keep the body politic alive and vigorous in all its parts. For we have come to realize that weakness in one vital part is a threat to the well-being of the whole.

So it is in the relations between nations, although the revolution in thought, which we accept in national affairs, makes less rapid progress in international affairs. Your great country, I am glad to say, is giving a lead. Speaking for Canada, I would like to say that we take great pride in being able to march with you, and to carry our share of the burden. In a world where at times the future looks depressingly somber, the brightest ray of hope comes from the whole-hearted and generous assumption of international responsibility, which has transformed the United States in a few years from a virile, vigorous youth, with few outside responsibilities, to an equally vigorous and powerful adult, with all the great responsibilities of leadership in a family of free nations.

These trends have a special significance for engineers. A century ago, civilian engineers were essentially technicians, in the broad meaning of that word. They were able, competent, and enterprising. But for the most part their interest lay in designing, constructing, and operating. The decision as to whether, why, and when works were to be undertaken, and how they were to be operated were usually taken by others. Even when I graduated, the fields of management and policy direction in industry were being entered by only a few enterprising engineers with strong pioneering urges.

We all know what has happened during the last fifty years. The pendulum has swung full over, and it is the rule today, rather than the exception, that engineering-trained executives are to be found in the highest managerial posts of major industries. If any should doubt that claim, all he need do is look around this distinguished gathering to realize that not only technical questions, but the highest policy decisions, which have placed this country at the top of industrial effectiveness, are today being made by men of our professional training.

America, however, was not the first country where scientifically trained men directed the national industrial machinery. In pre-war Germany, when her industrial strength was at its zenith, practically all industrial company directors of their giant firms were engineers or scientists, of real technical competence. From that observation about Germany, I think we should heed a vital warning: a nation cannot survive on technological superiority alone. Those who carry industrial responsibility must also feel real responsibility for, and exercise influence on, broad national policies, insofar as they affect the common good. They cannot afford to leave it to the other fellow; to shirk their responsibilities in providing political leadership.

I hope you will not think it immodest if I suggest that we engineers who are attempting to follow in the footsteps of Herbert Hoover by taking an active part in the legislative and executive branches of governments, are taking another step forward. Just as our predecessors brought to scientific and industrial policy the benefits of their training and talent, so we are bringing to bear on the terribly involved problems of present-day government the outlook and philosophy which is the hallmark of our profession.

The day is past when rule by a group of citizens trained in any one field can give satisfactory service to a nation in a complex world. The engineer's voice must be heard, and his presence felt, in the deliberations of national councils, for he has something unique to contribute to the understanding of present-day problems. And I would like to testify from my experience that an engineer can get elected, and is welcomed by his fellow legislators and administrators. Following many years of reasonably successful professional practice, I now find there is a special kind of satisfaction in public service which makes all the inevitable sacrifices seem unimportant.

In closing, may I take my theme one step further. As I have already remarked, whether we like it or not, we can no longer live to ourselves nationally, any more than we can individually. It is supremely important to realize that, while it is comparatively easy to be friends, it is exceedingly difficult to operate as effective and contented allies. It is as partners in an alliance of freedom-loving nations that we must work and fight if we are to survive collectively. The truth of this is obvious.

We all know that in business, in associations, in politics, whenever men come together for group action, frictions arise, incompatibilities appear, differences of interest are aggravated, a hundred-and-one adjustments are needed, that are not required in ordinary friendly social or business intercourse. As a distinguished American engineer once put it, "In the last analysis, the real objective and problem in a democracy is to live together as a large reasonably contented family, all working together for the common welfare. Human nature being what it is, this is no simple or easy task—compromises must be made."

Rt. Hon. C. D. Howe, Hon.M.E.I.C., gets Hoover Medal. The presentation was made on behalf of the Hoover Medal Committee by Mr. Scott Turner.

We have learned to work by compromise in local societies, in national groups, and in political parties, but it would be naive indeed to suggest that internal difficulties do not arise. What is even more naive, I think, is to be surprised when difficulties arise between allies, with different national backgrounds. It is imperative that we all realize fully that it is not an easy thing to operate as allies. (I fancy military and political leaders of all past alliances have been fully aware of this). But if we are to obtain our supreme goal, true world peace, it is of vital importance that we learn the techniques of international co-operation, just as we have mastered the techniques of national citizenship. In this, Mr. Chairman, I suggest our two countries have succeeded to a remarkable degree, and are offering a model for international co-operation.

By your action today in conferring on me, a Canadian, one of the greatest honours at your command, you have given yet one more proof, not only of your characteristic generosity, but of the mutual friendship and understanding that means so much to our two countries.

News of Other Societies

The second annual midwestern tool engineering conference sponsored by the Chicago Chapter of the **American Society of Tool Engineers** (10700 Puritan St., Detroit, 21, Michigan) in co-operation with the mechanical engineering department and extension division of the University of Illinois, will be held on Saturday, November 8, 1952, at Urbana, Illinois.

Arrangements for the conference are under the chairmanship of L. E. Doyle, associate professor of mechanical engineering at the University of Illinois.

The **American Chemical Society** will hold the 18th annual chemical engineering symposium at Evanston, Illinois, December 27-28, 1952.

The thirty-fourth annual meeting of the **American Standards Association,** will be held November 19, 1952, at the Waldorf Astoria Hotel, New York City.

The electric steel furnace conference of the **American Institute of Mining and Metallurgical Engineers** is announced for December 4-6, 1952, at the William Penn Hotel, Pittsburgh.

A conference on electronic computers will be held December 10-12, 1952 at the Park Sheraton Hotel, New York City, under the auspices of the **American Institute of Electrical Engineers,** the **Institute of Radio Engineers,** and the American computers manufacturers.

The **Society for Experimental Stress Analysis** (Central Square Station, Cambridge 39, Mass.) announces the annual meeting and exhibition, December 3, 4, 5, 1952. Hotel McAlpin, New York, N.Y.

The **American Society of Mechanical Engineers** (29 West 39th St., New York 18, N.Y.) has available information on plans for the annual meeting, to be held at the Hotel Statler, New York City, November 30 to December 5, 1952.

Elections and Transfers

At the meeting of Council held at St. Andrews-by-the-Sea, N.B., on Wednesday, September 10th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

K. Balas, *Toronto.*
W. R. Brennan, *Charlottetown.*
G. G. Cameron, *Oshawa.*
R. W. Cantle, *Toronto.*
D. H. Copp, *London.*
A. M. Croft, *Kingston.*
R. J. Cupit, *Montreal.*
D. J. Davies, *Montreal.*
A. Didkowskij, *Lethbridge.*
F. X. Godin, *Naudville.*
J. A. Hansford, *Toronto.*
M. H. Hofer, *Dorval.*
L. G. Holman, *Montreal.*
A. A. Kidd, *Kapuskasing.*
G. Koster, *Victoria.*
E. Kostitch, *Montreal.*
E. A. Lawrence, *Lethbridge.*
M. E. Levesley. *Montreal.*
G. G. Meyerhof, *Watford, Eng.*
S. C. Smith, *Ottawa.*
J. C. Thatcher, *Toronto.*
J. Thompson, *Toronto.*
C. G. Walley, *Nechako*
J. R. Welsby, *Quebec.*

Juniors:

A. Anderson, *Sherbrooke.*
S. Breuning, *Montreal.*
H. N. Burrows, *Hagersville.*
M. J. Chettleburgh, *Calgary.*
H. W. Dodge, *Bathurst.*
D. A. Douglas, *Montreal.*
M. J. P. Gleeson, *Kingston.*
H. P. Harkness, *Temiskaming.*
W. E. Lardner, *Uplands.*
P. C. Laptew, *Toronto.*
W. A. S. Marshall, *Welland.*
H. R. M. Murray, *Victoria.*
J. M. Schissler, *Mont Joli.*
H. E. Skelton, *Toronto.*
C. V. Steinberg, *Windsor.*
J. V. Thompson, *Smooth Rock.*
P. E. Wade, *Toronto.*
C. L. Wild, *Toronto.*

Transferred from the class of Junior to that of Member:

D. R. Abbey, *Toronto.*
J. L. Aikman, *Drummondville.*
F. E. Balshaw, *Calgary.*
D. D. Dick, *Vancouver.*
H. M. Haakonsen, *Chester, Pa.*
J. S. Hicks, *Winnipeg.*
W. F. Hull, *Bulawayo, S.R.*
B. F. Junkin, *La Paz, S.A.*
D. M. Millar, *Trail.*
J. L. Tessier, *Montreal.*
T. G. D. Whillans, *Kapuskasing.*

Transferred from the class of Student to that of Junior:

R. E. Dyson, *Esquimalt.*
D. S. Moyer, *Toronto.*

The following Students were admitted:

D. E. Allen, *Winnipeg.*
T. H. L. Bennett, *Toronto.*
E. W. Brooker, *Edmonton.*
J. Bumbulis, *Corner Brook.*
P. G. Cameron, *Kapuskasing.*
W. M. Chisholm, *Dartmouth.*
D. H. E. Cross, *Simcoe.*
D. W. Dowds, *Toronto.*
G. V. Fancy, *Sudbury.*
H. G. Ingram, *Kapuskasing.*
Jean Papanicolas, *Montreal.*
R. Pinard, *Montreal.*
D. L. Riefstahl. *Kapuskasing.*
H. J. Saaltink, *Niagara Falls.*
T. O. Smith, *Kapuskasing.*

Applications through Associations

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

ALBERTA

Members:

P. H. Blanchet.
L. E. Jackson.
A. G. Kaneen.
Wm. Korli.
J. H. Wall.
B. J. Wallace.

Junior:

F. H. Angebrandt.

Junior to Member:

J. G. Hutcheon.
L. P. Kane.
F. L. Sparks.

NOVA SCOTIA

Member:

P. J. Heckman.

Junior to Member:

B. E. Langley.

QUEBEC

Member:

R. McCallum.

Personals

News of the Personal Activities of Members of the Institute

W. E. P. Duncan, M.E.I.C., has been appointed general manager of the Toronto Transportation Commission to succeed Mr H. C. Patten who has recently retired.

Mr. Duncan joined the Commission staff in 1921 as assistant engineer of structures, two years later being appointed engineer of structures, a position he held until the end of 1938 when he became general superintendent of operations and maintenance. He became chief engineer in 1945 and has been operating manager of the Commission since 1949. The planning and construction work of the new rapid transit system have been

W. E. P. Duncan, M.E.I.C.

carried on largely under his direction and administration.

Born in Scotland, he received a B.Sc. degree in civil engineering from the Glasgow University. From 1910 to 1914 he was with the construction department of the Canadian Pacific Railway. During World War I, he served overseas with the Canadian forces and Royal Engineers from 1915 to 1919. For two years after the war he was an estimating engineer at the Carswell Construction Company in Toronto.

H. W. Tate, M.E.I.C., has been appointed consulting engineer of the Toronto Transportation Commission and will continue his duties as assistant general manager of the Commission.

H. W. Tate, M.E.I.C.

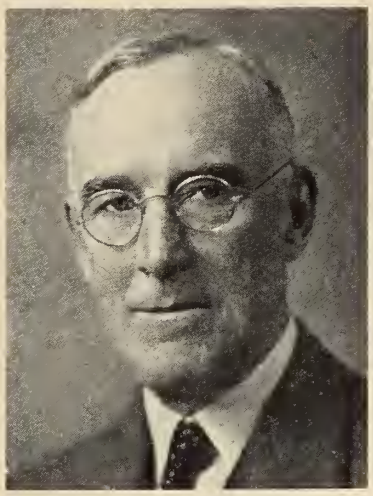
Born in England, Mr. Tate graduated in civil engineering from the University of Toronto in 1909 and spent some years in mining, railway and municipal engineering. In 1915 he served overseas with the C.E.F. and two years later he was transferred to the Canadian Engineers with which he served until the end of the War as second in command with the rank of major.

He joined the Toronto Transportation Commission in 1920 as an assistant engineer in the War Department and in 1924 he was placed in charge of the department with the title of assistant engineer of way at the end of that year. In 1927 he was appointed assistant manager and in 1939 became assistant manager in charge of engineering, holding that position until 1945 when he was appointed assistant general manager.

Mr. Tate has been with the Commission since the commencement of its activities and has been prominently identified with track rehabilitation, reconstruction and extension work carried out by the Commission since it took over the Toronto Railway Company property. He has also been largely responsible for negotiations and discussions with neighbouring municipalities served by the Commission.

In 1951 Mr. Tate was elected vice-president of the Canadian Transit Association, and was elected president of the Association earlier this year.

R. A. C. Henry, M.E.I.C., of Montreal, has been placed in charge of the special projects branch of the Department of Transport which has been transferred to Montreal to direct the preparation of detailed plans and designs required in connection with the construction of the St. Lawrence Seaway. He will direct the preparation of the engineering submission to the International Joint Commission in support of the Application of the Government of Canada for approval of the St. Lawrence Power Development Project.



R. A. C. Henry, M.E.I.C.

Mr. Henry is a prominent engineer and well known in the transportation field. He is a former director of the Bureau of Economics of the Canadian National Railways and has held important Government positions as Deputy Minister of Railways and Canals and Chairman of the Air Transport Board.

H. W. Lea, M.E.I.C., has been appointed by the Department of Transport to undertake an investigation to determine the effect on navigation, and down-river interests, of removing the Gut Dam in the St. Lawrence River, and to report on the advisability or otherwise of removing the dam progressively if this is considered necessary.

Mr. Lea who is a consulting engineer in Montreal and Ottawa, a McGill grad-

H. W. Lea, M.E.I.C.

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uate in civil engineering, was at one time director of the Wartime Bureau of Technical Personnel, and Co-ordinator of the Department of Reconstruction and Supply.

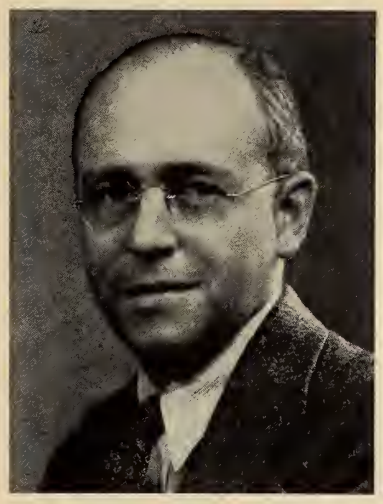
E. K. Lewis, M.E.I.C., has been transferred by Imperial Oil Limited from Winnipeg to Ioco, B.C., as superintendent of the refinery at Ioco.

Mr. Lewis has been with Imperial Oil Limited since 1934. He worked at Dartmouth, N.S., and in the engineering and development section of the company at Sarnia. In 1946 he was production manager of the Polymer Corporation and in 1948 he became superintendent of the Imperial Oil Refinery at Montreal. He went to Winnipeg in 1951 as superintendent of the manufacturing department.

J. L. McKeever, M.E.I.C., former works engineer at the Canadian General Electric Company's Peterborough Works, has been appointed manager of the engineering department of the Apparatus Division. This division is a self-contained unit responsible for all of the company's activities in apparatus product lines, and the engineering department is one of six operating and service departments which have been established to provide for the various functions of the business.

Mr. McKeever joined this company after his graduation from the University of British Columbia in 1930. He took the "Test" course at Peterborough and then joined the induction motor engineering division. In 1938 he was appointed general engineer and became the only application engineer in the Peterborough Works. He headed the industrial and central station engineering section until his appointment as works engineer in December of last year.

J. L. McKeever, M.E.I.C.



H. F. Bush, M.E.I.C.

H. F. Bush, M.E.I.C., has been appointed general staff supervisor of the Bell Telephone Company of Canada, Montreal, to advise and assist on all personnel matters involving the engineering headquarters staff and to co-ordinate engineering matters of a company-wide nature. Mr. Bush was previously general staff engineer for the company and will continue to be responsible for special headquarters staff assignments. He joined the company in 1922, after graduating in electrical engineering from McGill University.

R. L. Weldon, M.E.I.C., well-known executive in the pulp and paper industry, who was awarded the Julian C. Smith Medal of the Institute earlier this year, was appointed a director of the Canadian Chemical and Cellulose Company Limited, at a special meeting of shareholders of the company in August.

E. H. Allen, M.E.I.C., has left the Demerara Bauxite Company Limited, Mackenzie, British Guiana, where he was mechanical superintendent, to join Costain-Brown Limited of London, England. He is deputy resident manager at the Coryton Refinery at Essex, England, which is being built for the Vacuum Oil Company.

A. D. Hodgson, M.E.I.C., has been appointed manager for communications and airborne project co-ordination in the Electronic Equipment Department of the Canadian General Electric Company at Toronto, Ont. He was previously a consulting engineer in the electronics division.

Mr. Hodgson is a graduate of the Bedford Engineering College, England.

C. K. Hurst, ME.I.C., holds the position of engineering adviser to the Canadian Section of the International Joint Commission at Ottawa, Ont.

Previously Mr. Hurst had been on the hydraulic staff of the Canals Branch of the Department of Transport since 1941. Before that he was with the Water Works Department of the City of Edmonton.

During the War he served as a lieutenant with the R.C.N.V.R. at Halifax. He graduated in civil engineering from the University of Alberta in 1937 and received a M.Sc. degree from Iowa University in 1940.

R. A. Shier, M.E.I.C., is employed by the Board of Railway Commissioners from Canada as district engineer at Calgary, Alberta.

He was previously division engineer with the Canadian National Railway at Belleville, Ont.

R. A. Frigon, M.E.I.C., has joined the Technical Assistance Administration of the United Nations in New York. He holds the position of program officer in the Division of Planning and Co-ordination.

Mr. Frigon has been assistant research officer with the Division of Building Research of the National Research Council at Ottawa, Ont. He was also secretary, in association with Mr. R. S. Ferguson, of the Associate Committee on the National Building Code, and secretary of five of the technical sections of the committee on Civil Defence.

From 1947 to 1950 he was in Washington, D.C., as head of the Canadian scientific liaison office and attached to the Canadian Embassy as scientific officer.

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In 1946 he was regional representative for the Research and Development Branch of the Department of Reconstruction in Montreal. Earlier he was assistant engineer in the diesel engine division of the Dominion Engineering Works Limited at Lachine, Que., and had also been a lecturer in mechanics of materials at the Ecole Polytechnique, Montreal.

He is a past chairman of the Junior Section of the Montreal Branch of the Institute.

J. P. C. McMath, M.E.I.C., has accepted the position of assistant professor in electrical engineering at the University of Manitoba in Winnipeg, Man.

Mr. McMath has been for several years an engineer in the Electrical Laboratory, Wire and Cable Division of the Northern Electric Company at Montreal, Que.

H. Mackenzie, M.E.I.C., has left his position as superintendent with T. C. Gorman (Canada) Limited at Halifax, N.S., to become resident engineer for the Strait of Canso Crossing for O. J. McCullock and Company, consulting engineers, who are responsible for the design and supervision of this work.

Mr. Mackenzie was earlier a supervisor at the Railway Drydocks, Atlantic Coast, with the Department of Munitions and Supply at Halifax, N.S.

W. O. Horwood, M.E.I.C., has been appointed manager of the newly created Toronto branch of Lyman Tube and Bearings, Limited, which has been set up to provide better service and delivery facilities.

W. O. Horwood, M.E.I.C.

Mr. Horwood graduated from McGill University in mechanical engineering in 1937 and joined the Lyman Tube and Bearings, Limited in 1945. Prior to his present appointment, he was located in Montreal as eastern sales manager of the firm's tubing and railway division.

P. B. French, M.E.I.C., former bearings sales manager with Lyman Tube and Bearings, Limited, has been appointed branch manager at Montreal; a building program designed to provide modern accommodation for this company branch will shortly be undertaken in the west of the City.

P. B. French, M.E.I.C.

J. P. Beauregard, Jr.E.I.C., is taking a two year course at Rolls-Royce Limited at Derby, England, where he will have the opportunity to extend his knowledge of the gas turbine aspects of aeronautical science and will receive practical education in all phases of the science.

Winner of the John Bousall Porter scholarship in the Department of Engi-

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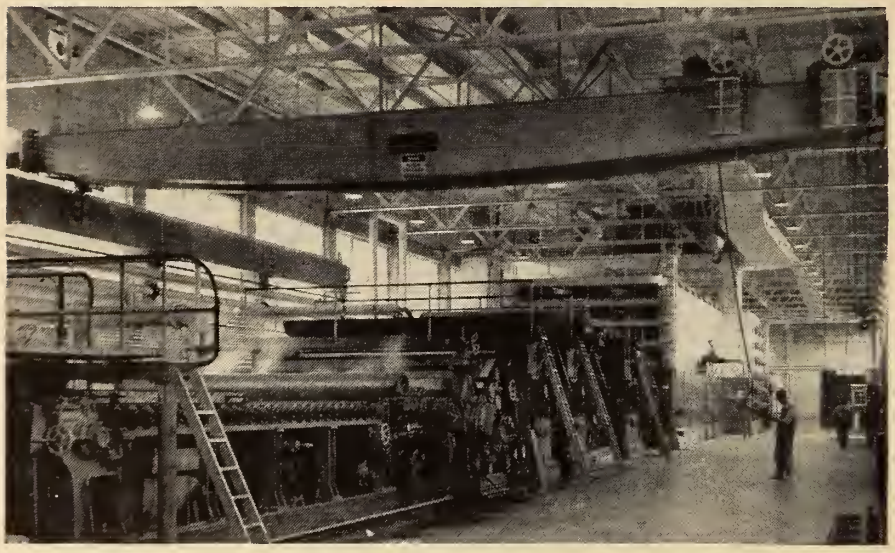

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neering at McGill University, Mr. Beauregard continued his studies for two years, specializing in gas turbine engines, particularly in regard to aeronautical engineering. He gained his Master's degree in engineering earlier this year. Prior to entering McGill University he graduated with a B.Sc. degree from Loyola College, Montreal.

On completion of his post graduate work he carried on a research project for a degree in work related to aerodynamic design of combustion chambers in gas turbine engines; this was done in conjunction with the McGill Dynamics Laboratory at Macdonald College.

Mr. Beauregard attained marked success in the building of model aircraft and he has won many prizes in Eastern Canadian competitions.

J. P. Beauregard, Jr.E.I.C.

A. E. Benn, JT.E.I.C., has recently joined the Department of Transport in the Canal Services Branch at Montreal.

Mr. Benn was previously resident engineer with Cartier, Macnamara-Manning, Morrison and Knudson, at Mont Joli, Que.

He graduated in civil engineering from Queen's University in 1948 and then joined the Highway Location Survey at Whitehorse, Y.T. He has also worked for Wallace A. Mackey Limited at Weston and at Norland, Ontario.

T. P. Halley, JT.E.I.C., is with the Demerara Bauxite Company at Mackenzie, British Guiana, South America.

Previously he was with the Aluminum Company of Canada Limited and earlier with the Newfoundland Fluorspar Limited. Mr. Halley graduated in civil engineering from the Nova Scotia Technical College in 1949.

J. H. Keating, JT.E.I.C., has joined C. C. Parker and Associates Limited at London, Ont.

Mr. Keating has recently returned from service with the R.C.E. in Korea. Previously he was in the department of reconstruction and Supply, Public Projects Branch at Ottawa, Ont.

F. R. Dorward, JT.E.I.C., is with the Canadian General Electric Company in the Lamp Division at Vancouver, B.C.

Previously he was in the Lighting Service Department of the Canadian General Electric Company Limited at Toronto, Ont.

Mr. Dorward graduated from the University of Alberta in electrical engineering in 1949.

L. C. Banfield, JT.E.I.C., has left Bonar and Bemis Limited at Burlington, Ont., and is now employed with Thomas Bonar and Company (Canada) Limited, as factory superintendent at East Angus, Que., where a new multiwall paper bag plant is being opened in October.

Mr. Banfield graduated in electrical engineering from the University of Saskatchewan in 1950.

N. A. Macdougall, JT.E.I.C., went to England as correspondent for the Toronto Telegram and London, England, Weekly Aeroplane to cover the "Exercise Mainbrace". This is NATO's combined sea and air exercise in the North Sea. Mr Macdougall flew to England in a R.C.A.F. plane with the Honourable Lester Pearson to join the aircraft carrier "Magnificent".

Mr. Macdougall graduated from the University of British Columbia in 1950; he was among six third-year engineering students who received prizes awarded by the Association of Professional Engineers of British Columbia for special summer work on technical subjects in 1949.

He was previously with the Technical Service Council in Toronto. He will be taking up employment with the B.A. Oil Company later this year.

C. A. Geddes, JT.E.I.C., is employed in the electronics division of the Canadian Westinghouse Company Limited at Hamilton, Ont.

Previously he was with the Brantford Engineering and Manufacturing Company at Hamilton.

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Mr. Geddes graduated in mechanical engineering from Queen's University in 1950.

A. C. Rae, Jr.E.I.C., is with the McColl Frontenac Oil Company Limited at Montreal. Previously, he was with Kraft Foods Limited at Outremont, Que.

Mr. Rae graduated from McGill University in civil engineering in 1948 and worked for a time with the Geodetic Survey of the Department of Mines and Resources at Ottawa, Ont.

H. G. Mitchell, Jr.E.I.C., is working in the Product Planning Section of the Canadian General Electric Company Limited at Montreal, Que.

Previously he was in the Appliance Division at Toronto, Ont. Mr. Mitchell graduated in mechanical engineering from the University of Manitoba in 1949.

O. W. Knight, Jr.E.I.C., is with the Inspection Services of the Department of National Defence at Ottawa, Ont.

G. K. McRae, Jr.E.I.C., is with Sheldons Engineering Company at Montreal, Que. He had previously been with this company at Galt, Ont.

Mr. McRae graduated in mechanical engineering from Nova Scotia Technical College in 1950.

W. M. M. Ogden, Jr.E.I.C., is with the Coldstream Copper Mines at Kashabowie, Ont. Previously he was with the North Shore Paper Company at Baie Comeau, Que.

Mr. Ogden graduated in mining geology at the University of Toronto in 1950.

A. J. Shama, Jr.E.I.C., is with the Geodetic Survey at Ottawa. Ont.

Mr. Shama graduated in civil engineering from McGill University in 1948.

S. J. J. Medwadowski, Jr.E.I.C., is with the Foundation Company of Canada Limited at Montreal.

Previously he was structural designer with the Canadian National Railways, Central Region, at Toronto, Ont. He has also worked as senior designer draughtsman for the Leremont Company Limited in London, England.

Mr. Medwadowski graduated from the Polish University College, London, England, in 1950.

Erling Hesla, Jr.E.I.C., has joined the Scott Paper Company at Chester, Pennsylvania.

Previously he was with the Canadian General Electric Company at Peterborough and at Toronto, Ont.

Mr. Hesla graduated in electrical engineering from the University of British Columbia in 1947.

John Renchko, Jr.E.I.C., has joined the Canadian Comstock Company as a field engineer in the frequency conversion department.

Previously he was with M. and S. Mine at Bienfait, Que.

Mr. Renchko graduated in electrical engineering from the University of Saskatchewan in 1949.

L. J. Eibner, Jr.E.I.C., has accepted a position as structural engineer with the Laminated Structures (1952) Limited at Montreal. Previously he was with the Foundation Company of Canada at Montreal.

Mr. Eibner graduated in civil engineering from the University of Manitoba in 1948.

Stanley Bugaresti, Jr.E.I.C., is with Western Dominion Coal Mines Limited at Taylorton, Sask.

Previously he was a junior engineer with the City of Regina, Saskatchewan.

Mr. Bugaresti graduated in mechanical engineering from the University of Saskatchewan in 1950.

N. H. Dalziel, Jr.E.I.C., is a sales engineer with the Victor Manufacturing and Gasket Company of Canada, Limited.

Previously he was on a general training course with the Steel Company of Canada at their Hamilton Works, Hamilton, Ont.

Mr. Dalziel graduated in mechanical engineering from Queen's University in 1948.

D. B. Downing, Jr.E.I.C., is employed at the Air Material Command Headquarters in Ottawa, Ont. and holds the rank of flight lieutenant in the telecommunications branch.

Mr. Downing graduated in electrical engineering from the University of New Brunswick in 1949.

P. E. Poisson, Jr.E.I.C., is with the Dominion Textile Company Limited in the standards department at Montreal.

Mr. Poisson graduated in civil engineering from Ecole Polytechnique in 1949.

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R. A. Gyles, JT.E.I.C., is with Renold Coventry Limited at Winnipeg, Manitoba.

Previously he was with this company at Toronto, Ont. and earlier he was with R. and M. Bearings (Canada) Limited, at Toronto.

Mr. Gyles graduated in mechanical engineering from the University of Saskatchewan in 1948.

F. R. Thompson, JT.E.I.C., has joined the Johns-Manville Company, Asbestos, Que.

Mr. Thompson was previously design engineer with Cockshutt Plow Company Limited, Brantford, Ont. He was graduated with a B.Sc. degree in mechanical engineering from the University of Saskatchewan in 1946.

D. A. Young, S.E.I.C., who obtained his degree in civil engineering this year from the University of Manitoba, has been awarded a travelling fellowship. He has accepted the E. B. Kernaghan bursary for business administration at Harvard University.

V. Strautmanis, S.E.I.C., has left the Hydro-Electric Power Commission, Toronto, Ont., to join the Dominion Bridge Company, Lachine, Que.

Mr. Strautmanis was graduated from the University of Toronto in civil engineering in 1951.

K. C. Swance, S.E.I.C., formerly with the International Resistance Company, Toronto, Ont., has joined the Ingersoll Machine and Tool Company, Woodstock, Ont.

Mr. Swance received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1951.

H. H. Toda, S.E.I.C., who was graduated this year from Queen's University in electrical engineering, has joined the Hydro-Electric Power Commission in Toronto.

Edward Oliver, S.E.I.C., is employed in the motor and generator engineering office of the Canadian General Electric Company Limited at Peterborough, Ont.

Mr. Oliver graduated in electrical engineering from Queen's University in 1951.

Rene Guimond, S.E.I.C., is a plant engineer with the St. Raymond Paper Company at Portneuf, Que.

Mr. Guimond graduated from Ecole Polytechnique in 1951 in civil engineering.

M. J. Ferguson, S.E.I.C., is in the engineering department of the Bell Telephone Company at Montreal, Que.

Mr. Ferguson graduated in mechanical engineering from the Nova Scotia Technical College.

R. C. Drinkwater, S.E.I.C., has left A. V. Roe (Canada) Limited to become an aeronautical engineer, commercial pilot with Spartan Air Services Limited at Ottawa, Ont.

Mr. Drinkwater graduated in aeronautical engineering from the University of Toronto in 1951.

J. R. Goff, S.E.I.C., is with the Hydrographic Survey at Victoria, B.C.

Mr. Goff graduated in electrical engineering from the Nova Scotia Technical College in 1951.

W. A. Johnson, S.E.I.C. (University of Manitoba, civil engineering, 1952) has accepted a position as petroleum engineer with the California Standard Company of Calgary, Alta. and is at present employed on development work at Virden, Manitoba.

W. H. Loney, S.E.I.C., is a production engineer with the Hobart Manufacturing Company Limited at Owen Sound, Ont.

Mr. Loney graduated in mechanical engineering from the University of Toronto in 1951.

H. L. Nicoll, S.E.I.C. (Nova Scotia Technical College, 1952) is employed as a design engineer with Consolidated Paper Corporation in the Wayagamack division at Three Rivers, Que.

R. J. F. Sherk, S.E.I.C. (University of Toronto, chemical engineering, 1952) has joined The Nichols Chemical Company Limited at Toronto, Ont.

H. R. Peele, S.E.I.C., is a junior engineer with the Township of Scarborough, Ont.

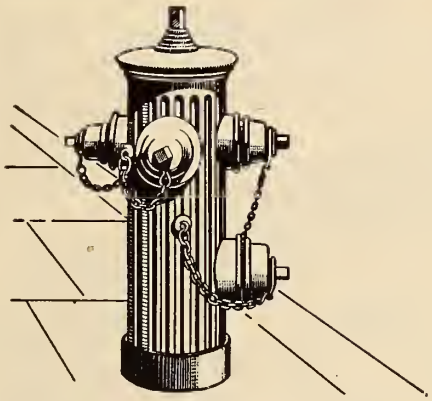
Mr. Peele graduated in civil engineering from the University of British Columbia in 1951.

R. H. Scott, S.E.I.C., is employed as a research engineer in the fusion and joining department in the research and development laboratories of the Kaiser Aluminum and Chemical Corporation at Trentwood, Washington, U.S.A.

Mr. Scott graduated in mechanical engineering from the University of British Columbia in 1951 and took a graduate's training course with the Canadian Westinghouse Company Limited at Hamilton, Ont.

G. M. Black, S.E.I.C. (Nova Scotia Technical College, electrical engineering, 1952) has joined the Quebec Hydro-Electric Commission at Montreal.

Robert Boisvert, S.E.I.C. (McGill University, mechanical engineering, 1952)



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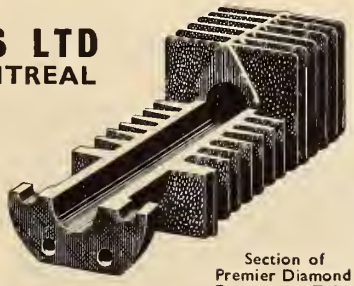

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has joined the Fluor Corporation Limited at Los Angeles, California, U.S.A.

E. V. Bates, S.E.I.C. (University of Manitoba, mechanical engineering, 1952) is working as a development assistant with Canadian Industries Limited at Shawinigan Falls, Que.

J. C. Bernier, S.E.I.C., is on the engineering staff of the Bell Telephone Company of Canada at Three Rivers, Que.

Mr. Bernier graduated in electrical engineering from Laval University in 1951.

R. A. Harnois, S.E.I.C., has recently accepted employment with the National Heating Products Company Limited, in Montreal.

Mr. Harnois graduated in chemical engineering from Laval University in 1951 and had been working for the Aluminum Company Limited of Canada.

E. H. Light, S.E.I.C. (McGill University, electrical engineering, 1952) is employed with Messrs. Combe and Ryan, Consulting engineers, in Montreal.

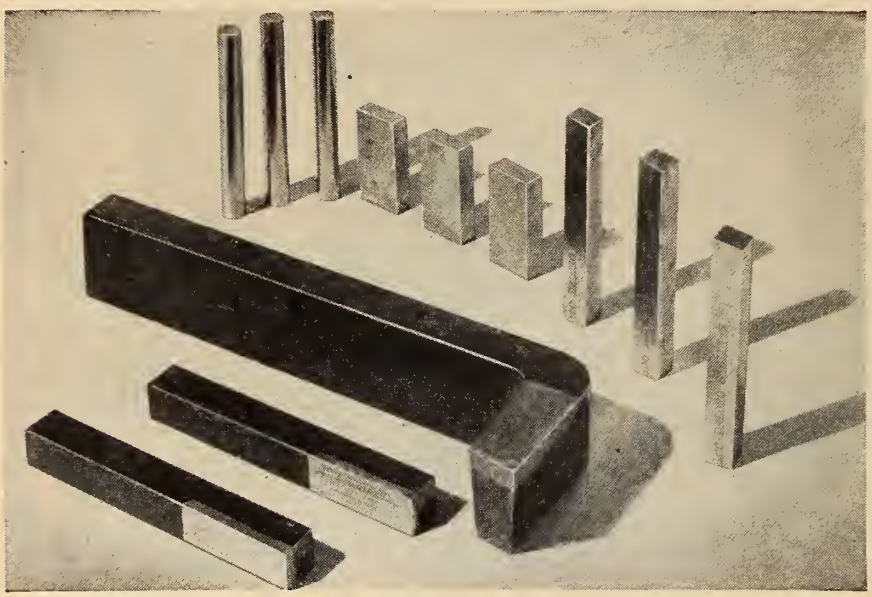
Leonce Cloutier, S.E.I.C., is on the engineering staff of C. D. Howe Company at Montreal. He was formerly with Canada Packers at Montreal.

Mr. Cloutier graduated in chemical engineering from Laval University in 1950.

K. A. Millions, S.E.I.C., is serving as a Flying Officer with the R.C.A.F., in the Air Division at Paris Headquarters, France.

Mr. Millions graduated in civil engineering from the University of Alberta in 1951.

G. L. Kingston, S.E.I.C. (McGill University, mechanical engineering, 1952) is working as assistant mechanical engineer for the Canadian Pulp and Paper Association at Montreal.



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J. E. Feir, M.E.I.C., Lethbridge, Alta., September, 1952.

A. G. Diamondopulos, Montreal, Que., September 5, 1952.

W. S. Wilson, M.E.I.C., Toronto, Ont., September 6, 1952.

Lt.-Col. J. B. Dunbar, M.E.I.C., Halifax, N.S., September 8, 1952.

Cdr. (E) A. Graham Bridgeman, M.E.I.C., Ottawa, Ont., September 10, 1952.

W. B. Scott, M.E.I.C., Stanstead, P.Q., September 16, 1952.

J. M. Thomson, Jr.E.I.C., Toronto, Ont., September 19, 1952.

K. M. Middleton, Jr.E.I.C., Toronto, Ont., September 19, 1952.

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P. E. Buss, M.E.I.C., Thorold, Ont., September 28, 1952.

Obituaries

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

J. K. Horsburgh, M.E.I.C., senior hydraulic engineer of the Water Resources Branch of the Manitoba Government, was killed in a plane crash at the end of July, 1952.

Mr. Horsburgh was born in Winnipeg, Manitoba, in 1919, and was educated at Kelvin Technical High School. He graduated from the University of Manitoba in 1941 and was winner of the Gold Medal for that year. Shortly after he joined the R.C.E. and served overseas until the end of the war; he was awarded the Military Cross for gallantry in action.

In 1946 he joined the Water Resources Branch of the Manitoba Government and was appointed representative of Manitoba on the Greater Winnipeg Dyking Board in 1951.

Mr. Horsburgh joined the Institute as a Student in 1939, became a Junior in 1946 and a Member in 1947. He was a member of the Management Committee of the Winnipeg branch of the Institute and was chairman of the Papers Committee.

J. P. Mooney, M.E.I.C.

J. P. Mooney, M.E.I.C., manager of the Mooney Construction Company, died on August 30, 1952, at the Lahey Clinic in Boston, Massachusetts, U.S.A.

Mr. Mooney was born in Saint John, N.B., and was educated at St. Malachy's School and Saint John High School. He graduated in civil engineering from the University of New Brunswick in 1916.

He entered the employ of B. Mooney and Sons Limited, general contractors in Saint John until 1922 when he founded the Mooney Construction Company in partnership with his brother, the late Thomas Mooney, which firm has carried on since that time.

Mr. Mooney joined the Institute as a Junior in 1918, became an Associate Member in 1920 and Member in 1940. He was a past chairman and a past councillor of the Saint John Branch of the Institute, and also a past president of the Association of Professional Engineers of New Brunswick.

G. A. Jenkins, M.E.I.C., foremost paving technologist of Warren Brothers Company, Cambridge, Massachusetts, died on July 1, 1952.

Mr. Jenkins was born at Orwell, P.E.I., in 1886, and graduated from Queen's University in 1909. He worked for several years as instrumentman and resident engineer on street, railway and pavement construction in Alberta.

In 1912 he joined the Warren Brothers Company as district representative of the engineering laboratory on control of street and highway construction work in Alabama, Mississippi, Georgia, North Carolina, Kentucky and Pennsylvania; and later, in the same capacity, for the district comprising North Dakota, Montana, Wyoming, Idaho, Washington, Oregon, Manitoba, Saskatchewan, Alberta and British Columbia.

In 1919 he was appointed superintendent of Warren Brothers Company (Engineering) laboratory and inspection service on street and highway construction in the North West States and in Western Canada.

Mr. Jenkins joined the Institute as a Student in 1908, became a Junior in 1911, Associate Member in 1922 and Member in 1940.

C. W. Doody, M.E.I.C., former traffic superintendent with the Saskatchewan Government Telephones, Regina, died suddenly on August 25, 1952.

Mr. Doody was born at Winchester, England, in 1886, and came to Canada in 1907 to join the Nova Scotia Telephone and Telegraph Company. In 1913 he joined the Saskatchewan Government telephone department. During World War I, he went to England to join the R.E. with the rank of lieutenant and served in the searchlight division. He returned to Regina in 1919 to resume work in the telephone department and in 1921 he became traffic superintendent, a position he held until his retirement in 1951.

Mr. Doody was president of the Saskatchewan branch of the Telephone Pioneers of America; he joined the Institute as an Associate Member in 1938 and became a Member in 1940. He was accepted as a Professional Engineer in Saskatchewan in 1930.

F. J. Bell, M.E.I.C., former vice-president and manager of C. A. Parsons of Canada Limited, died at Guelph, Ontario, on August 26, 1952.

Mr. Bell was born at Saint John, New Brunswick, and graduated from St. John's College, Winnipeg; later he took a three year course with the Canadian General Electric Company at Peterborough. After two years on the construction staff in Montreal, he joined the sales department. In 1907 he became secretary-treasurer of Canadian Crocker-Wheeler Limited and two years later he was appointed general manager of the British Power Company in Cobalt. In 1912 he was made general manager of Canada Wire and Cable Company of Toronto. He was president of this company from 1914 to 1921 and for three years was a director of the Laurentian Power Company in Quebec.

In 1924 he became Canadian representative of C. A. Parsons and Company, and the Howard Grubb, Parsons and Company, later being promoted to vice-president and general manager of C. A. Parsons and Company.

Mr. Bell joined the Institute as a Member in 1918 and attained Life Membership in 1948. He was a past president of the Electrical Manufacturer's Association, Toronto, discontinued on the formation of the Electric Service League; a member of the Institution of Electrical Engineers of Great Britain and of the American Society of Mechanical Engineers.

Pretnoro Pisacreta, S.E.I.C., was killed in a plane crash near the Chatham, N.B., training base on May 23, 1952.

Mr. Pisacreta was a pilot officer in the R.C.A.F., stationed with No. 1 Fighter Operational Training Unit at Chatham and was on a routine training exercise when the crash occurred.

Born in Trail, B.C., in 1928, he received primary and high school education there and studied at the University of British Columbia for three years prior to joining the R.C.A.F. in 1951.

Mr. Pisacreta joined the Institute as a Student in 1949.

Pretnoro Pisacreta, S.E.I.C.

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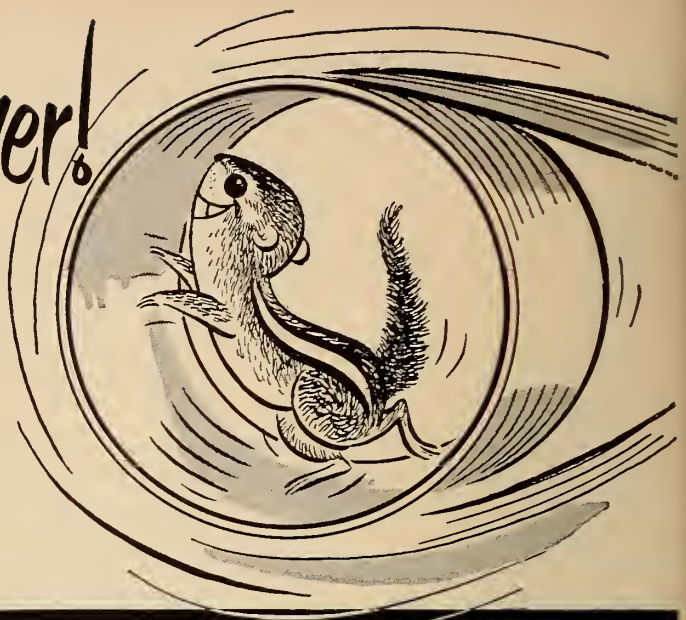

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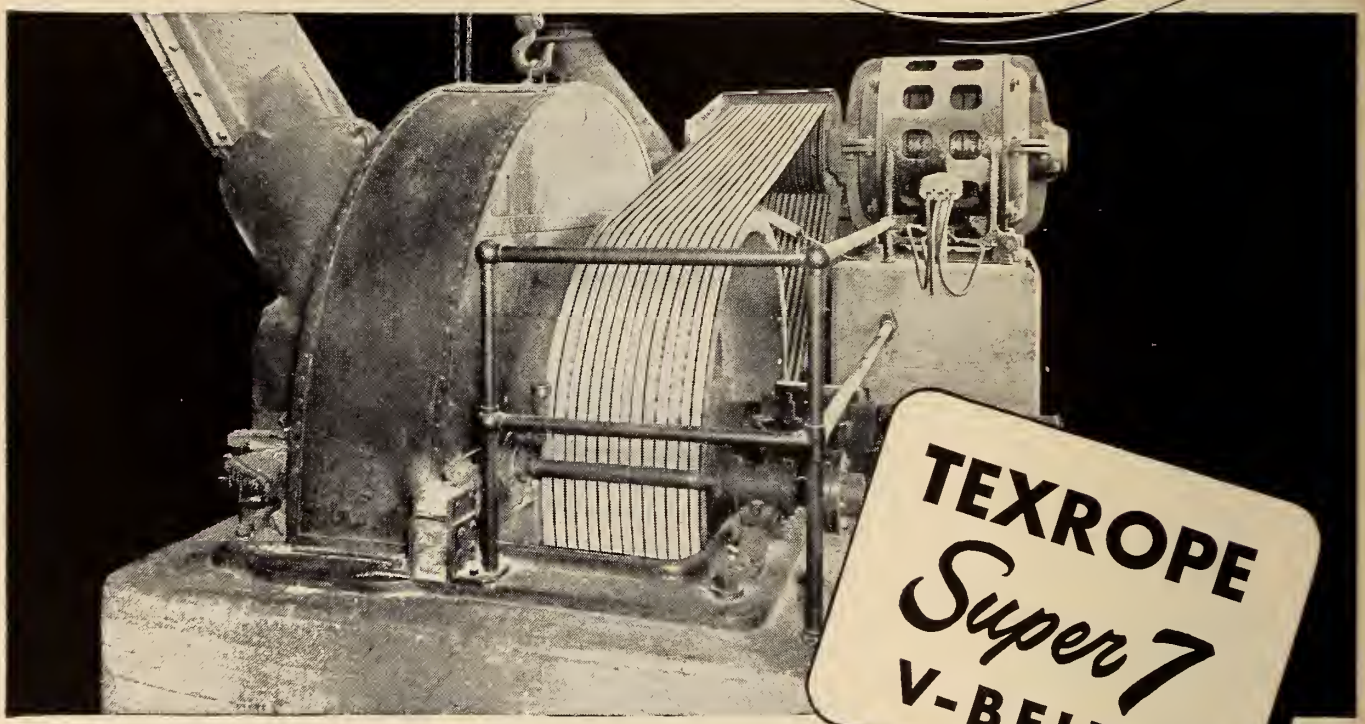

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Employment Service

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

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

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

Situations Vacant

CHEMICAL

YOUNG CHEMICAL ENGINEER to locate on research staff and to man new research laboratory now in process of building. The position will entail plant process and new process research in nickel refining and related work. Location Ontario. Apply to File No. 4359-V.

JUNIOR OR INTERMEDIATE chemical engineer required to fill vacancy in the control department of a pulp and paper mill located in The Maritimes. Apply to File No. 4362-V.

CHEMICAL ENGINEER OR equivalent required by manufacturer of water treatment and conditioning equipment. Applicant will be trained in phases of work with which he is not familiar. General duties; laboratory analysis, instrument calibration, field testing and correction, study analysis, occasional sales and interview of prospects etc. age range 25 to 35 years. Apply to File No. 4365-V.

CHEMICAL ENGINEER to act as sales engineer for organization in Montreal. Prefer a man, under 35 years of age, with industrial selling experience, particularly in the metal finishing field. Salary is open. Apply to File No. 4368-V.

CHEMICAL SALES representative (Sherbrooke & Quebec area) the work consists of handling all phases of industrial sales, including actual sales contracts, technical service, correspondence. Large oil company located in Montreal. Apply to File No. 4369-V.

CIVIL

CIVIL ENGINEER graduate from recognized university to fill post of Deputy Director of Public Works, Bermuda. Applicant should have experience in road building and surfacing, general building construction, including reinforced concrete, steel and timber, and be capable of structural design. Experience in handling men, and in executive and administrative control is essential. Age 35 to 40. Apply to File No. 4354-V.

PUBLIC HEALTH ENGINEER required in Western Canada. Graduate Civil engineer, preferably with graduate work in public health engineering and some public health engineering experience; to make field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewerage systems, stream pollutions, deficient drainage etc. Closing date for applications Nov. 8, 1952. Apply to File No. 4355-V.

CIVIL ENGINEER to act in the capacity of resident engineer for a consultant on a project in the Quebec area. The applicant should be conversant with building construction services, survey and planning of work and also should be prepared to spend a good portion of his time on administration. Apply to File No. 4357-V.

YOUNG GRADUATE CIVIL engineer for position of transitman on a railway division in Province of Quebec. Commencement salary $275.00 a month increases according to service and experience. Apply to File No. 4366-V.

STRUCTURAL DESIGN ENGINEER required in Western Canada. Civil engineer with not less than 5 years experience. The suitable candidate will be one who can accept considerable responsibility, which includes investigation of construction projects and submitting recommendations. He will be required to prepare designs, material estimates, etc., and will give technical direction to men engaged as designers and draughtsmen. Applications should state age, education and experience. Apply to File No. 4370-V.

ELECTRICAL

ELECTRONICS ENGINEER 3 to 10 years experience in design and development of radio and T.V. telecommunications for commercial and defence projects. Location Ontario. Apply to File No. 4356-V

ELECTRICAL ENGINEERS EXPERIENCED on small transformers for research and development department. Location Ontario. Apply to File No. 4356-V.

ELECTRICAL ENGINEER required for municipally operated electric utility in Prairie City. Preferably with 1 or 2 years experience. Duties consist of design of 13200 and 2300 volt feeder lines, pole layouts, cost studies. Some supervision of construction. Hospitalization and medical and pension schemes, excellent working conditions. Please state age, qualifications and salary expected. Apply to File No. 4367-V.

MECHANICAL

WELL ESTABLISHED COMPANY requires young mechanical engineer with thorough machine shop experience, interested in sales work. Willing to pay well for capable man. Position involves trips to Europe. Apply to File No. 4353-V.

MECHANICAL ENGINEERS with 3 to 10 years experience in manufacturing, tooling and design for manufacturing for work on defence projects and home appliances. Location Ontario. Apply to File No. 4356-V.

MECHANICAL MAINTENANCE Superintendent with 15 to 20 years mechanical maintenance experience, preferably mining and milling operations. Should be capable organizer and experienced in organizing a large maintenance staff. Age 40 to 45 years, although consideration will be given to a man of exceptional qualifications outside this range. Housing available. Location Province of Quebec. Apply to File No. 4361-V.

MECHANICAL ENGINEER recent graduate, to perform under direction, production design work on light steel structures, and electromechanical components. Previous experience while desirable is not essential. Salary will depend upon qualifications. Location Ottawa. Apply to File No. 4371-V.

GRADUATE ENGINEER preferably mechanical engineering, with 5 years or more of industrial engineering experience age range 27-35 years. The duties will be to activate studies of retailing outlets of large organization, with the purpose of improving layouts of future stores and material handling, in order to obtain most effective and economical operation. Salary range is $6,000.00. Opportunities excellent for imaginative person. Apply to File No. 4375-V.

MINING

MINING ENGINEER required primarily for survey and lay-out work with anywhere from 2 to 5 years experience. Location Province of Quebec. Apply to File No. 4361-V.

MINING ENGINEER with some experience underground for position of safety engineer under supervision of safety director. Location Province of Quebec. Apply to File No. 4361-V.

MISCELLANEOUS

AN ENGINEER required by Western Municipality with varied programme of expansion, for position of office engineer. Applicant must have had general design experience on various types of structures and preparation of estimates and specifications. He will be required to direct a small staff of draughtsmen and compile plans for proposed works. Permanent position for one with necessary qualifications. Please give full particulars of age, education, experience, when available and salary desired. Apply to File No. 4352-V.

SANITARY ENGINEER with some experience in sewer and/or sewage treatment design and construction for Western Municipality. Permanent position for one with necessary qualifications. Please give full particulars of age, education, experience, when available and salary desired. Apply to File No. 4352-V.

SALES ENGINEERS for Toronto and Montreal, manufacturer located in Toronto of various power equipment. Apply to File No. 4358-V.

ENGINEER REQUIRED as assistant to plant engineer and for various produc-

PUBLIC HEALTH ENGINEER

REQUIRED BY

Saskatchewan Department of Public Health

Salary — up to $339 per month (including cost of living bonus) depending upon qualifications.

Requirements: Graduate civil engineer, preferably with graduate work in public health engineering and some public health engineering experience; to make field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewerage systems, stream pollutions, deficient drainage and other environmental factors.

For application forms and further information write to Public Service Commission, Legislative Bldg., Regina.

Closing date for receipt of applications — November 8, 1952.

tion problems eventually leading to supervisory position for the right man. Located in The Maritimes. Apply to File No. 4360-V.

MECHANICAL OR MINING ENGINEER with some experience in ventilation work. Applicant should be definitely interested in following ventilation work. Position open is that of assistant to senior ventilation engineer. Staff accommodation available for single man. Location Province of Quebec. Apply to File No. 4361-V.

SENIOR MECHANICAL OR civil engineer with experience along mill designing and building design. Man should be a good designer and draughtsman, capable of leading junior engineers. Housing available. Location Province of Quebec. Apply to File No. 4361-V.

TELEPHONE CARRIER sales engineer, graduate engineer preferred, experience on standard type carrier in Canada desirable, would be located in Toronto or Montreal. Apply to File No. 4363-V.

CONSTRUCTION SUPERINTENDENT required immediately in Nfld. to act as general superintendent. Contracts include large housing development as well as industrial and commercial buildings. Will make 1 or 2 year employment contract covering very satisfactory salary plus percentage of profit. Reply giving details regarding age, education, experience and income required. Apply to File No. 4364-V.

FULL INFORMATION is available for a large number of vacancies that exist for engineers in all fields of the profession to work for the Canadian Government under the Columbo Plan. Locations South and East Asia. Apply to File No. 4372-V.

ENGINEER REQUIRED with concrete or concrete construction experience with sales ability to represent American manufacturer in Canada. After training in home office applicant would have to be capable of opening branch office in either Montreal or Toronto. Age range from 30 to 45 years. Salary open. Apply to File No. 4373-V.

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

CHEMICAL

CHEMICAL ENGINEER to act as development engineer in applied chemical research and process development to pilot plant stage. A bachelor's degree with high academic standing. Preference will be given to those with post-graduate training or with proven aptitude for research and development work. Salary range $3550. to $5200. per annum according to education and years of related experience. Excellent accommodation, housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

JUNIOR ENGINEER or technical graduate with chemical background for technical control in the synthetic fibre industry. A certain amount of laboratory control and development work will be involved, a knowledge of statistical evaluation or quality control would be an asset. Good opportunity for eventual advanceemnt into the production department. Pension plan, group insurance and cost-of-living bonus provided. Location in progressive town in Eastern Townships about seventy miles from Montreal. Apply to File No. 4337-V.

CHEMICAL ENGINEER required to act under direction of the officer in charge of the materials section of the directorate of Armament Development, to make specific investigations and studies with respect to the use of non-metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and development organizations in Canada, the United States and United Kingdom. Graduation in Chemical Engineering from a recognized university; about six years' experience in the plastics field; ability to prepare well written reports; personal suitability; physical condition. Apply to File No. 4347-V.

CHEMICAL ENGINEER to act under direction of the officer in charge of the propellants and explosive section of the Directorate of Armament Development, to make specific investigations and studies with respect to ammunition explosives and propellants. Duties will require close liaison with the chemical industry and visits to armament design and development establishments in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in chemical engineering; about four years' diversified experience at increasingly responsible levels in the chemical engineering field; experience in development, inspection or production of explosives preferred; ability to prepare well written reoprts; personal suitability satisfactory physical condition. Apply to File No. 4347-V.

RECENT GRADUATE chemist or chemical engineer to assume direction of laboratory for control physical and chemical plant producing abrasives. Located in Quebec. Married men preferred, housing available. Salary commensurate with experience. Apply to File No. 4350-V.

CIVIL

CIVIL ENGINEER is required by the Canadian Institute of Steel Construction. Applicants should be bilingual with a minimum of ten years' experience for the position of Eastern Representative of their body, with headquarters in Montreal. Applicants should state particulars of education and practical background. The selected engineer must be prepared to travel in Eastern Canada covering all of the Maritime Provinces, Newfoundland and Quebec. Applications will be treated as strictly confidential. Apply to File No. 4312-V.

CIVIL ENGINEER required by a long established engineering and surveying firm located in Ontario. Must have at least two years practical experience. Reply stating age, experience and salary expected to File No. 4336-V.

QUALIFIED CIVIL ENGINEER with experience in varied municipal engineering work required in Western Canada. Applicant to state age, experience and salary required. Apply to File No. 4345-V.

ELECTRICAL

TWO ELECTRONIC ENGINEERS for production design of radar equipment. Applicants should have 3 to 5 years experience preferably. Location Ontario. Apply to File No. 4309-V.

ELECTRICAL ENGINEER recent graduate, required by small manufacturer of power equipment for Montreal sales office. Previous experience in sales is desirable but not essential. Applicants must be bilingual. Apply to File No. 4315-V.

GRADUATE B.Sc., preferably with test course and sales experience in electrical apparatus equipment, age around 30 to 35. Salary open. Apply to File No. 4342-V.

ELECTRONICS ENGINEER to act under the supervision of the officer in charge of the Analysis Section of the Directorate of Armament Development to be responsible for the electronic engineering phases of the analysis of weapon systems. Duties will require visits to armament design and development organizations in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in Electrical Engineering; about six years' diversified experience at increasingly responsible levels in the electronic engineering field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament Development, to make specific investigations and studies with respect to guided missiles, serve mechanisms, remote and other control systems. Duties will require close liaison with industry and visits to armament design and development establishments in Canada the United States and the United Kingdom. Graduation from a university of recognized standing in Electrical engineering; about five years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production, ability to prepare well written reports; personal suitability, satisfactory physical condition. Apply to File No. 4347-V.

Opportunities for Electronics and Mechanical Engineers

Canadian Westinghouse offers unusual incentives for the technical and professional skills required to man its fast-growing Electronics Division. Attractive positions for:

Electronics Engineers — 3 to 10 years' experience in Design and Development of Radio and TV, Radar, UHF and VHF for Commercial and Defence Projects.

Mechanical Engineers 3 to 10 years' experience in Manufacturing, tooling and design for Manufacturing for work on Defence Projects and Home Appliances.

Electrical Engineers — Experienced on small Transformers for Research and Development Department.

These are permanent positions, combining security with excellent opportunities to get ahead in a Company which has always held engineering skill at a premium! Salary fully commensurate with qualifications. Location, Hamilton. Special assistance given in securing living accommodation. Please give full details as to qualifications in first letter. Replies strictly confidential. Address replies to:

Manager of Engineering,
Electronics Division,
Canadian Westinghouse Co. Ltd.,
Hamilton, Ontario.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament development to make specific investigations and studies with respect to test equipment such as velocity and radar doppler measurement, high speed scopes, monitor units, radar targets, meters, special instruments to follow flight of shell or rockets. Duties will require close liaison with industry and visits to armament design and development establishments in Canada, the United States and the United Kingdom. Graduation from university of recognized standing in Electrical engineering; about four years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production. Apply to File No. 4347-V.

ELECTRICAL ENGINEERS recent graduates or experienced to work on communications with large organization in Montreal. Apply to File No. 4348-V.

MECHANICAL ENGINEER

MECHANICAL ENGINEER preferably with a masters degree and background and interest in hydrodynamics. An interest in ship structures would be of value. Duties include responsibility for the planning of trials and the collection, analysis and reporting of essential data on the performance characteristics of novel designs of surface craft and for design of structural modifications as trials results show desirable. Apply to File No. 4307-V.

MECHANICAL OR METALLURGICAL engineer with sales background to take full responsibility for a new Ontario business of small, well established American company, manufacturing bearing metals. Apply to File No. 4308-V.

MECHANICAL ENGINEER with about 5 to 10 years experience of production experience on radar equipment. Location Ontario. Apply to File No. 4309-V.

MECHANICAL ENGINEER required for field work in Ontario. Applicant with not less than 3 years experience in the installation of machinery and other mechanical equipment. Apply to File No. 4311-V.

FOUR GRADUATE MECHANICAL engineers required for work in Montreal office and four senior draughtsmen. Applicants should not have less than 3 years experience in detailed design of high quality machinery parts. Apply to File No. 4311-V.

MECHANICAL ENGINEER required in Montreal to act as assistant works engineer. Applicant should have 3 to 10 years experience in industrial work. Apply to File No. 4320-V.

MECHANICAL ENGINEER to act as development engineer in experimental work connected with design of atomic energy reactors and associated equipment. A bachelors degree with high academic standing. Preference will be given to those with post graduate training or with proven aptitude for research and development work. Salary range $3550 to $5200 per annum according to education and years of related experience. Excellent accommodation housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

MECHANICAL ENGINEER, recent graduate to learn air conditioning design, estimating and draughting. Location Montreal. Apply to File No. 4343-V.

MISCELLANEOUS

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate interested in following employment in ilumination. Apply to File No. 4306-V.

METALLURGICAL, ELECTRICAL, Mechanical or Chemical engineer required by metallurgical plant located in Province of Quebec for production department. Salary for 1952 graduate $300.00 per month, for graduates with one or two years experience the salary is open for discussion. Applicant should be bilingual. Apply to File No. 4310-V.

FIELD ENGINEER required by manufacturer of premium quality industrial power transmission V-setting and drives, full range of specialized industrial hose and other mechanical rubber goods throughout industrial, mining, lumbering, paper and construction markets. Qualifications:— preferably graduate engineer with minimum 1 year selling experience, owner of serviceable car. Based centrally in New Brunswick or Nova Scotia. Age 23 to 40. Apply to File No. 4313-V.

SALES ENGINEER required by American manufacturer of industrial pumps, manufacturing in Canada. Territory Montreal and area. Age 25 to 35. Engineering degree and some experience preferably in hydraulic field. Apply to File No. 4316-V.

ENGINEERS (grade 1 $2970.00-$3498.00) plus cost of living bonus of $907.00 per year, required by City of Montreal. Engineering or applied science degree from a recognized university, must be a member of The Corporation of Professional Engineers in P.Q. For further information apply to File No. 4317-V.

SANITARY ENGINEER Grade 3 ($4290.00-$4950.00) plus cost of living bonus $907.00 per year required by City of Montreal. Must have a degree in engineering or applied science from a recognized university and preferably experience in public health in matters of sanitation, preferably with a federal, provincial or municipal health department. For further information apply to File No. 4317-V.

A LEADING MONTREAL manufacturer of electronics equipment requires men with electronics design and development experience for an expanding program in the following fields, relay communications systems, VHF and UHF equipment, radar design and production, general electronics design and development. Please give full particulars of age, education and experience in reply. Apply to File No. 4318-V.

UNIVERSITY GRADUATE for research and development work on textiles for a Toronto research laboratory. Applicants should possess a degree in physics, chemistry or textile technology and have some experience in the field of cotton textiles. This position is suitable for a young man, preferably not over 30. Salary will be commensurate with qualifications and experience. Applications or requests for further information should state age and give full particulars of training and previous experience. Apply to File No. 4319-V.

SENIOR VACANCIES exist in all branches of the profession with the Hebrew Instiute of Technology, Haifa, Israel. For all further details apply to File No. 4324-V.

ENGINEERS REQUIRED by expanding operations in Ontario, interested in aircraft engineering, sheet metal work. Apply to File No. 4325-V.

ENGINEERS-IN-TRAINING for B.C. Forest Service. Salary $271-$327. Graduation from recognized university civil or forest engineering, or registered as engineer-in-training with Association Professional Engineers B.C. Promotion to high grades made when full professional registration completed. Positions permanent, superannuation plan. British subjects, under 45 years unless ex-servicemen. Apply to File No. 4331-V.

METALLURGICAL ENGINEER to act as development engineer in experimental work in physical metallurgy connected mainly with design of atomic energy reactors and associate equipment. A bachelors degree with high academic standing. Preference will be given to those with post-graduate training or with proven aptitude for research and development work. Salary range $3550 to $5200 per annum according to education and years of related experience.

Construction Superintendent

Large contractor in Newfoundland requires immediately experienced general superintendent. Contracts include large housing development as well as industrial and commercial buildings. Will make 1 or 2 year employment contract covering very satisfactory salary plus percentage of profit. Reply giving details regarding age, education, experience and income required. Apply to File No. 4364-V.

Excellent accommodation, housing available for married staff. State particulars as to age, marital status education and experience in detail in first letter. Location Chalk River. Apply to File No. 4333-V.

PLANT ENGINEER required by one of Canada's largest textile mills located in the Maritimes engaged in the manufacture of rayon fabrics. Applicant should have executive qualifications and experience in the mechanical and electrical fields. Job covers maintenance of buildings and machinery, plant protection, planning for new projects responsibility over power and steam generation and costs. Apply to File No. 4334-V.

DRAUGHTSMAN REQUIRED by organization in Ontario. Applicant should possess either civil engineering training, structural option preferred, and some experience in steel and concrete building work, or several years experience in a good drawing office. Apply to File No. 4338-V.

GRADUATE ENGINEER, electrical or mechanical, with a minimum of five years experience in industrial or process engineering, for modern pulp mill in Northwestern Ontario. Salary open depending on experience. Excellent group insurance and pension plans available. Apply in writing stating full particulars of experience, age, marital status, availability, etc. to file number 4339-V.

PROCESS ENGINEERS to study facilities of fabrication to adequate available equipment. Study of production output to its lowest manufacturing cost. Plan sequences of operations to be followed in producing an article, specify machines, fixtures, cutting tools and set-up to be used. Qualifications: University graduate or equivalent, proven knowledge of machine shop practice (production) toolmaking. Modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

TIME STUDY AND methods technicians to complete application of time and motion study and methods engineering technique. University graduate or equivalent. Training on time and motion study. Proven experience in methods engineering and mechanical background. Good salary and working conditions in modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

SALES ENGINEER (mechanical or civil) preferably with ten years experience with industry required by a firm of industrial engineers in Ontario. Excellent opportunity for an engineer who is able to meet executives of industry and to promote engineering service. Apply to Fil No. 4341-V.

ELECTRONIC AND MECHANICAL ENGINEERS to do deveopment engineering work on electronic equipment and production engineering work in the fabrication and assembly of electronic equipment respectively. Location Ontario. Apply to File No. 4344-V.

PROFESSIONAL ENGINEERS required in Province of Quebec by manufacturer of newsprint paper and kraft products in the capacity of assistant to sulphite superintendent, assistant to technical service superintendent, and an engineer to join the maintenance and engineering department staff. Apply to File No. 4346-V.

ENGINEER to exercise supervisory and technical control over the Analysis section of the Directorate of Armament Development and to prepare assessments of the effectiveness of weapon systems in collaboration with other technical officers. Graduation from a university of recognized standing in physics, mathematics or general engineering; post graduate training with successful completion of the requirements for a Master's degree in any of the above fields; about twelve years' diversified experience at increasingly responsible levels in the fields of physics, mathmatics and/or engineering. Apply to File No. 4347-V.

ENGINEER to work in consultation with the officer in charge of the Analysis section of the Directorate of Armament Development, to be responsible for mathematical phases of analysis of weapon systems. Graduation from a university of recognized standing in mathematics or appied science; post graduate training with successful completion of the requirements for a Master's Degree; about six years' diversified experience at increasingly responsible levels in the Applied mathematics and Statistical Analysis Field. Apply to File No. 4347-V.

ENGINEERING PHYSICIST required to act under direction of the officer in charge of the Analysis Section of Directorate of Armament Development, to be responsible for physical engineering phases of analysis of weapon systems. Graduation from a university of recognized standing in Physics; post graduate training desirable; about six years' diversified experience at increasingly responsible levels in the physical engineering fields; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ENGINEER (BALLISTICIAN) to act under supervision of the officer in charge of the Anaylsis Section of the Directorate of Armament Development, to be responsible for the ballistic phases of the analysis of weapon systems; the preparation of terminal, external and internal ballistic evaluations. Graduation from a university of recognized standing in mathematics or physics; about six years' diversified experience at increasingly responsible levels in the applied mathematical field; experience in ballistics preferred; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ENGINEER (METALLURGIST) required to act under direction of the officer in charge of the Materials Section of the Directorate of Armament Development, to make investigations and studies with respect to use of metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and development organizations in Canada, the United States and United Kingdom. Graduation in metallurgical engineering from a recognized university; about six years' experience in the metallurgical field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

STRUCTURAL DESIGN ENGINEERS recently graduated or experience. Some experience on hydraulic structures is preferable. Work for final stage of the design of power houses and dams. Consulting engineers for jobs in U.S.A. Apply to File No. 4351-V.

Situations Wanted

CIVIL ENGINEER and Land Surveyor, M.E.I.C., 26 years varied experience abroad and in Canada, in: railroad, airport, road, dam, watersupply, irrigation, building, factory construction and related survey of layouts and locations. In charge of survey parties and supervising and directing construction. Service with the Royal Engineers in the Middle East and East Africa. Married, bilingual. Seeks responsible position in Ontario or Quebec, where experience will be of value. Apply to File No. 489-W.

GRADUATE ENGINEER, 10 years experience, married, desires position with initiative and responsibility in plant engineering or similar work. Experience consists mainly of plant engineering in design and maintenance with a large company having a wide variety of equipment. Work included administrative, mechanical, electrical, instrumentation and various types of piping. Apply to File No. 548-W.

MECHANICAL ENGINEER, M.E.I.C., P.Eng., Quebec, Technical College, Stuttgart 1924, about 18 years experience in Canada in steel plant maintenance, aircraft tool design, mechanical handling equipment, experimental design, and for the past 4 years with large public utility in construction department. Available on short notice, married, no children. Montreal area preferred. Apply to File No. 1862-W.

CIVIL ENGINEER, M.E.I.C., available extensive experience in administration and all phases of heavy construction. Location immaterial. Apply to File No. 2474-W.

Saskatchewan Petroleum Industry

Opportunities

PETROLEUM ENGINEER — $271 - $327

PETROLEUM GEOLOGIST — $271 - $327

Salaries include variable cost of living bonus.

Engineer required to perform field and research work on gas and oil reserves. Geologist to perform laboratory work on studies of the stratigraphy of the sedimentry area of the Province.

Minimum Requirements: University graduation in related field such as geological, petroleum chemical, or mechanical engineering, but as a geologist for the petroleum geologist position and preferably supplemented by related experience. Competition will close as soon as suitable applicants obtained.

Apply to: The Public Service Commission,
328 Legislative Building,
Regina, Saskatcehwan.

MECHANICAL ENGINEER, B.Sc. (M.E.) M.E.I.C., P.Eng. (Ont.) 14 years varied engineering experience in design, production and administration. Desires position with scope for advancement in overall management responsibilities. Apply to File No. 2745-W.

CIVIL ENGINEER, B.Eng., (McGill 44), M.E.I.C., P.Eng., P.Q., Ass. Member CPPA, 35, married, car, speak French. Experience: 3 years small tool manufacture; 18 months paper mill maintenance and construction; two years woodlands engineering for paper company on North Shore; over two years Assistant Woodlands Engineer for Paper company in Central Quebec (including six months as resident engineer on a development project on the North Shore); just completed contract with U.S. Geological Survey on ECA loan to Directorate of Colonial Surveys in East and Central Africa. Desire work in woodlands or construction, or other, in Canada or abroad. Apply to File No. 2897-W.

JR.E.I.C., P.ENG., grad. McGill 1949, age 27, single. Experience in design and construction of reinforced concrete and prestressed concrete, and multiple construction techniques. Familiar with construction costing systems. Available on reasonable notice to present employer. Apply to File No. 2956-W.

JR.E.I.C., P.ENG., grad. McGill 1949, age 27, single. Extension courses in business administration, experience in construction, surveying, municipal engineering works, estimation, costing systems, administration. Available on reasonable notice to present employer. Apply to File No. 2956-W.

ELECTRICAL ENGINEER, B.Sc.E., P.Eng. (Ont.) 5 years experience in electrical manufacturing, internal control and technical sales. Desirous of improving present position with greater scope of responsibility. Presently completing M. Comm. course at Varsity at nights. Completed marketing, and accounting and statistics. Apply to File No. 2975-W.

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

HEATING AND VENTILATING and electrical design services. Plans and specifications, by professional engineers. Apply to File No. 3120-W.

MANAGEMENT AND FIRE PROTECTION services surveys and reports by professional engineers. Apply to File No. 3120-W.

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one month notice to present employer. Apply to File No. 3460-W.

CIVIL ENGINEER, M.Eng., Jr.E.I.C., P. Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement. Montreal area preferred. Apply to File No. 3466-W.

CIVIL ENGINEER, with eight years general field experience obtained on Hydro-Electric construction, age 32, married, B.S.C., Jr.E.I.C., P.Eng., have attained responsible status; desire employment in Ontario or the West with small construction firm with eventual interest in business; presently working in isolation location. Apply to File No. 3604-W.

CHIEF INDUSRIAL production engineer, age 38, graduate engineer, British A.M.I. Mech.E., A.M.I. Prod.E. 1st class, C.G.C. (Honors) 24 years experience, apprentice trained, requires executive position. Diesel, automobiles, gearing machine tools, industrial consulting, covering a comprehensive field in all phases of works and production management with world famous companies. At present employed with well known Canadian company in the capacity of job engineer. Principals who can offer a highly responsible position with genuine prospects of advancement, commencing salary being of secondary importance, apply for further particulars to File No. 3617-W.

CHEMICAL ENGINEER, 1950 graduate of Queen's University, Jr.E.I.C., P.Eng. (Ontario), with two years production experience, desires a position in sales engineering. Presently employed in specialty selling in Toronto area. Available immediately. Apply File No. 3674-W.

YOUNG MECHANICAL ENGINEER, Jr. E.I.C., P.Eng., single, over 5 years design experience in process industries (mostly pulp and paper), power and construction, desires a responsible position offering a genuine opportunity for initiative and advancement. Available on two weeks notice to present employer. Personal interview by appointment. Montreal preferred. Apply to File No. 3777-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 1948 graduate, married. Desires sales position in Montreal. Experience includes two years student engineering course with Can. Westinghouse Co. Three years with public utility on line design and construction, hydro-electric power generation and transmission, short circuit system studies, system relay planning. Apply to File No. 3841-W.

MECHANICAL ENGINEER, Univ. Grad., A.M.I. Mech.E., (G.B.), M.E.I.C., P.Eng. 20 years experience in development various types high speed IC. engines, (carburettor, diesel, petrol-injection, supercharged, etc., from 20-1,000 H.P.) At present chief research engineer in large motor manufacturers in G.B. Desires position where initiative is appreciated. Apply to File No. 3863-W.

MECHANICAL ENGINEER, 1951 graduate, S.E.I.C., P.Eng., single, age 26, desires employment in Ontario or the Prairie Provinces in the field of design, maintenance and construction (plant engineering) or industrial engineering. Experience includes industrial engineering, cost estimating, time and motion study, planning floor layouts for machine product shops, machine loading, steam power plant operation, drafting and experience in the maintenance and repair of modern farm machinery. Apply to File No. 3913-W.

CIVIL ENGINEER, University of Saskatchewan, 1951, Jr.E.I.C., age 23, single, and seeking employment in Western Canada, with construction company or consultant firm. Available latter part of July. Have been employed by large city corporation in Eastern Canada. Apply to File No. 3926-W.

CIVIL ENGINEER, S.E.I.C., (McGill '52), desires to work for a contractor or a consulting firm doing concrete or structural design of buildings. Apply to File No. 3988-W.

PLANT ENGINEER'S POSITION WANTED, M.E.I.C., 37 year old maintenance supervisor of a chemical industry desires more responsibility and scope. Have had special experience in labour controls and preventive maintenance which produced a substantial reduction of costs. Engineering background is mechanical and electrical. Desire position paying upper level of professional engineers of Ontario grade V salary schedule. Apply to File No. 3989-W.

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

B.Sc., A.M.I.E.E., English, age 27, emigrating to Canada later this year, desires post in which initiative and ability may be exercised. 8 years' experience design and development electronics, cables, transformers and mercury pool rectifiers. Some sales experience. Past 2 years spent on application of mercury pool high frequency inverters to induction heating for both forging and melting of metals. Location not important. Apply to File No. 3995-W.

CIVIL ENGINEER, Jr.E.I.C., 1950 graduate desires part time work in Montreal, evenings and weekends, detailing concrete reinforcing including bar lists, quantity take-offs, etc. Apply to File No. 3996-W.

ELECTRICAL ENGINEER, University graduate, 40, British, A.M.I.E.E., desires progressive position in Canada. Good education, wide general knowledge, experience in design and testing of electrical machines, plant maintenance, electric traction, operation of thermal and water power stations, commercial operations and in particular organization and administration of electric utility. Adaptable, widely travelled, fluent French and several other languages. Apply to File No. 3997-W.

AGRICULTURAL ENGINEER, M.E.I.C., Sask., 1943. Experience includes production, maintenance and plant expansion and construction. With D.I.L. one and half years, large food processing firm five years, and dehydration firm three years. Available on short notice. Desire position with greater responsibilities and good future. Apply to File No. 3998-W.

CIVIL ENGINEER, M.E.I.C., commissioned Dominion Land Surveyor, soon to be retired from the federal civil service, graduate of Queens 1914, feels thoroughly fit for many more years service, in a supervisory capacity. Experience of over 40 years in the surveying profession, comprising legal and subdivision surveys: mapping by plane table and aerial photographs; road construction and townsite layouts; extensive knowledge of computing ground control for aerial mapping and reconnaissance. Apply to File No. 3999-W.

GRADUATE ENGINEER, B.Eng., S.E.I.C., (mining) McGill 1951, age 28, married, presently employed as layout engineer with large base metal mining company, seeks opening where initiative, capability and ambition would lead to position of technical or supervisory responsibility. Experience includes three years R.C.A.F., two summers miltary engineering (roads and bridges), varied experience in surveying, both topographic and underground, and underground mining. Presently enrolled in business management course, LaSalle Extension University. Interested in administration, report writing, planning. Apply to File No. 4000-W.

ELECTRICAL ENGINEER, Jr.E.I.C., B.Sc., University of Alberta 1948 P.Eng., age 31, 2 children, 2 years industrial training course, 1 year engineering on specification of materials and processes, 1

A vacancy exists for the post of Deputy Director of Public Works, Bermuda

SALARY. £2,000 per year. Additional cost of living bonus of £150 per year, subject to onnual review. The post is pensionable after 10 yeors' service, and admission to the pensionable establishment. Retiring age 60 to 65.

LEAVE. Full pay leove 6 weeks per yeor accumulative for 2 years. Not more thon 3 weeks leave per year if spent in Bermuda.

Free passoge to Bermuda on engogement far afficer only. Applicant should be between 35 and 40 yeors af age, or thereabouts. He must be a graduate in Civil Engineering of a recognized college.

He should have experience in rood building ond surfocing, generol building canstruction, including reinforced concrete, steel ond timber, and be capable of structural design.

Experience in handling men, ond in executive ond odministrative cantrol is essentiol.

Appliconts should opply to

DIRECTOR OF PUBLIC WORKS
Homilton, Bermudo.

year engineering on automatic home laundry equipment. Would like to return to Alberta or Western Canada. Interested in all phases of engineering including manufacturing, sales and service work. Apply to File No. 4001-W.

CIVIL ENGINEER, M.E.I.C., graduate 1949, age 27, married, one child. Desires position with opportunity for experience and advancement, preferably in Western Canada. 3 years varied experience in design and construction. Apply to File No. 4002-W.

PART TIME WORK, desired by civil engineer, M.E.I.C., evenings and weekends in Montreal. Experienced in structural design; reinforced concrete, steel wood. Calculations and drawings. Plant layouts. Apply to File No. 4003-W.

ELECTRICAL ENGINEER age 25, double graduate with first class honours degrees in Pure Science (physics, mathematics) and in electrical engineering; graduate of the General Electric Test Course in Schenectady (58 weeks) and with 1½ years experience in well-known electric power concerns and utilties in Canada and overseas; desires a suitable position. Energetic with initiative and abiity to pick up new aspects. Willing to travel and work anywhere in Canada or overseas. Apply to File No. 4011-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1949) age 30, single, R.C.A.F. veteran. Three years assistant city engineer in an Ontario city. Desires position with future utilizing municipal experience, anywhere in Canada. Available 1953. Apply to File No. 4012-W.

CHEMICAL ENGINEER, Jr.E.I.C., graduate Toronto, 1950, married, age 34, ex-serviceman, 21 months experience as assistant plant manager in English titanium pigment manuacturing company, desires good opening in Ontario. Experienced in both production supervision and investigation of a wide variety of problems. Fifteen months vacation experience with a Canadian oil company. Available for interview after October 19th. Apply to File No. 4013-W.

ELECTRICAL ENGINEER, S.E.I.C., McGill 1951, P.Eng., Quebec, age 24, also graduate of Canadian General Electric Test Course. Presently employed with large manufacturer, desires job with greater responsibility and with a definite opportunity for advancement. Location of secondary importance. Available on several weeks notice. Apply to File No. 4014-W.

CIVIL ENGINEER, P.Eng., M.E.I.C., B.A.Sc., 1942, age 39 single. Varied experience, field and office large construction projects including logging operations, highway and airport construction, housing, docks, pulpmill. Desires responsible assignment as superintendent, project engineer, assistant plant engineer in construction or manufacturing organization. Position must require initiative, drive and executive ability. File No. 4015-W.

ELECTRICAL ENGINEER, P.Eng., Jr. E.I.C., 1948, B.Sc., in electronics. Graduate of test course of large electrical manufacturer, two years experience in testing and erection of equipment. Desire position with smaller manufacturer or consulting firm. Apply to File No. 4022-W.

ADMINISTRATIVE EXECUTIVE AVAILABLE. Advertiser desires administrative position in Montreal that will utilize his ability to organize and supervise, write clear reports, and maintain good public relations. He is a Civil Engineer, 31 years old, married, bilingual, and a born Montrealer. He has had considerable experience with government agencies in the construction and management of large housing projects, but would prefer now to enter into private enterprise. Apply to File No. 4023-W.

CHEMICAL ENGINEER, McGill University, 1950, Jr.E.I.C., O.A.P.E., 31, R.C. A.F. veteran, married. Presently employed by Ontario textile firm, doing laboratory work. Apply to File No. 4024-W.

MECHANICAL ENGINEER, S.E.I.C., one year experience in production, several months general engineering in paper and allied industry, presently employed desires change location. Bilingual, married. Apply ot File No. 4025-W.

CIVIL ENGINEER, A.M.I.C.E., Ph.D. (Imperial College in London), 36, wishes to contact prospective employers in connection with his pending immigration to Canada. Specialist in advanced design including shell structures and prestressed concrete. 13 years of experience in industry, research and university lecturing. Apply to File No. 4026-W.

CIVIL ENGINEER, N.S.T.C., 1952, Jr.E.I.C., age 33, married, three children, veteran R.C.E., extensive experience since 1938 in highway and building construction as chief of parties and job engineer. In the services, worked as topographical surveyor "A" and in photogrammetry. Desires position with responsibility in design or construction in reinforced concrete or steel with a well established firm, or as assistant engineer or planner for a municipality. Presently employed as development assistant at C.I.L. consolidated works at Shawinigan Falls. Available on short notice. Apply to File No. 4028-W.

1952 GRADUATE IN civil engineering, desires employment in soil mechanics and foundation field. Willing to accept employment in laboratory. Quebec Province preference as location. Apply to File No. 4029-W.

MECHANICAL ENGINEER, S.E.I.C., 1952 McGill graduate, desires position with a stable Canadian firm. Experience includes maintenance construction, direction and research. Apply to File No. 4033-W.

MECHANICAL ENGINEER, Mem. A.S. M.E., B.Sc., A.M.I. MechE., A.M.I.E.E., considerable experience senior technical and administrative positions at board levels, general mechanical engineering background with specialist knowledge uses and distribution of oxygen and industrial gases, also liquid petroleum gases, including American codes of practice, flair for getting results especially on new projects, 38, British but Canadian immigrant. Seeks interesting position any capacity anywhere in petroleum, industrial gas industry or any general engineering giving scope to drive, initiative and leadership. Apply to File No. 4034-W.

SAFETY ENGINEER, B.Sc., M.E.I.C., P. Eng., 13 years of varied engineering and design experience, 4 years specialized work in accident prevention and fire protection. Familiar with modern methods and capable of preparing and installing an up-to-date accident prevention program. Apply to File No. 4035-W.

FIELD ENGINEER, M.I.T. civil engineer and Harvard business school graduate, desires field engineering position with closely held contractor in which management and ownership participation is eventual possibility. Experience as World War II U.S. engineer officer, and as office engineer, personnel manager, and assistant to president of a large contractor. 28, married. File No. 4036-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948) desires employment in personnel, costing or planning work of any type. Four years experience in charge of municipal and public utilities work in a 5000 population Ontario town including construction, maintenance and quite extensive administration. Available anywhere in Canada upon one month's notice. Apply to File No. 4037-W.

CHEMICAL ENGINEER, Jr.E.I.C., P.Eng., 1949 B.Sc. 1947 scholarship student 1944-1949 age 25 single. Experience includes one year lecturer in chemistry at an Eastern University, two years in industrial dvelopment laboratory. Prefers job in chemical industy, anywhere in Canada. Available on approximately one month's notice 4038-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A.Sc. 1946, married age 34. Three years experience administration R.C.C.S., two years own business, experienced in power distribution, four years sales engineering in electrical hardware field including product improvement and design, sales, estimating, contact with most public utility men in Ontario. Eager to prove administrative ability in progressive manufacturing company. Prefer location Southern Ontario but will consider any location. Apply to File No. 4039-W.

GEOLOGIST AND MINING ENGINEER, P.Eng., B.A.Sc., M.Sc., Ph.D., age 34, married, three children. Presently employed. Thirteen years experience in mining and geology; underground mining in Northern Ontario and Quebec during three summer seasons, geological surveying in Quebec and Ontario, prospecting for mining, companies, geophysical field and office work, teaching. Desires permanent responsible position with well established firm. Apply to File No. 4040-W.

CIVIL ENGINEER and chartered structural engineer (arriving in Ontario 12 Nov.) specializing in design of reinforced concrete, light industrial and framed structures, seeks responsible position. Age 34, B.Sc., Eng., B.Sc. (maths and chemistry), A.M.I. Struct.E., taking final examination for A.M.I.C.E. in October. Experience comprises 3 years as reinforced concrete designer and checker with consulting engineers in London on industrial and commercial structures including liaison with architects. 7½ years miscellaneous construction experience, knowledge of modern methods of structural analysis, soil mechanics, current American design practice and J.C. and A.C.I. codes. Apply to File No. 4041-W.

MECHANICAL ENGINEER, M.E.I.C., age 35, 12 years experience in lay-out and design of air conditioning, ventilating heating, cooling, materials handling, machine design and draughting. Had own consulting firm and successfully developed inventions in Sweden. Presently employed with a consulting firm as a designer for air conditioning, ventilating, cooling etc. Desires a position with responsibility where initiative will lead to advancement. Speak perfect English. Moderate starting salary and no location preference. Apply to File No. 4047-W.

MECHANICAL ENGINEER, Jr.E.I.C., age 31, married, 2 children, ex-senior officer R.C.A.F., desires position as plant engineer or assistant in the mining or pulp and paper field. Experience includes 6 years in construction, plant layout, maintenance and supervision chiefly in the mining field. Apply to File No. 4048-W.

Attention, Members

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

This will result in a better service to everyone concerned.

TELEPHONE PLATEAU 5078

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

Materials Handling . . . Nature's and Man's

A common sight in the American tropics is this "crawling conveyor belt." In a relentless column, these Leaf-Carrying Ants invade a grove or cultivated field. Stripping it bare as they go, the ants carry off the spoils in an amazing demonstration of organization and efficiency. Instinctively two lines are formed. Advancing in one line, each ant slices out a piece of leaf with scissors-sharp jaws, then, joining the other line, it returns to the nest with its load held over the head like a parasol. In this, and in other Herculean feats like building bridges, culverts, tunnels, even rafts, ants demonstrate an *Engineering Instinct* that may well stand as an inspiring example to man.

Amazing as they appear, the ants' conveying methods are no match for the miracles of man's *Engineering Ingenuity*. Take any Gutta Percha installation . . . the conveyor belt in Nova Scotia that carries jagged-edged gypsum *for over a mile* from crusher to loading dock . . . the small standard belt for handling cartoned goods in super markets. Are these simply products of man's experience? Not at all. Each job has certain individual complexities. Each job needs "know-how". And because Gutta Percha's highly trained technicians and skilled craftsmen have this "essential" and bring it fully to bear on every problem, however small, they are best able to engineer belts for diverse types of materials handling.

58-M-2

GUTTA PERCHA & RUBBER, LIMITED
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Engineered Rubber for the needs of industry
Sales Offices in: HALIFAX • SAINT JOHN • QUEBEC • MONTREAL
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News of the Branches

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

Calgary

C. E. McNevin, M.E.I.C.,
Secretary-Treasurer

Engineers' Wives Association

Executive of Calgary Association

Officers of the Calgary Engineers' Wives Association for the coming year are: president, Mrs. W. A. Smith; honorary president, Mrs. T. D. Stanley; and secretary-treasurer, Mrs. W. C. Whittaker.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

Frank S. Gue, Jr.E.I.C.,
Branch News Editor

Executive Meeting

At an executive meeting held Aug. 26, Mr. W. L. Hutchison, M.E.I.C., advised that he would be leaving for overseas shortly on a four-month business assignment, and therefore tendered his resignation as Branch chairman.

Mr. E. T. W. Bailey accepted the executive's appointment as Branch chairman for the remainder of the term, and is once more occupying the post he ably filled during 1951.

The Professional Development Course Committee reported that plans were well advanced for the 1952-53 season, with greatly expanded accommodation to take care of the expected registration. The Course was well received, excellently attended, and greatly appreciated during 1951-52, the first year it was offered in Hamilton. The registration fee of $10 is to be retained, and it is anticipated that approximately 90 registrants will be accommodated.

British Engineers Visit Hamilton

Hamilton Branch activities got under way on September 15, when the executive and a small group of well known engineers of this city greeted a touring group of distinguished British engineers. The visitors were Allan Quartermain and E. Graham Clark, president and secretary, respectively, of the Institution of Civil Engineers; Sir David R. Pye and Brian G. Robbins, president and secretary of the Institution of Mechanical Engineers; and Sir John Hacking and W. K. Brasher, president and secretary of the Institution of Electrical Engineers.

The British group is touring under the auspices of the Institute, with the aim of meeting and talking to as many Canadian engineers as possible.

Inspection Trip

On September 20, in a joint meeting with the Toronto Branch, Hamilton Branch members were the guests of the H.E.P.C. as they inspected progress on the Sir Adam Beck Power Plant No. 2 in the Niagara gorge. The many conventional and some unconventional features of this important hydro power development were ably explained by a team of Hydro personnel. During the proceedings, the assembled engineers demolished an excellent dinner provided by their hosts and greatly appreciated.

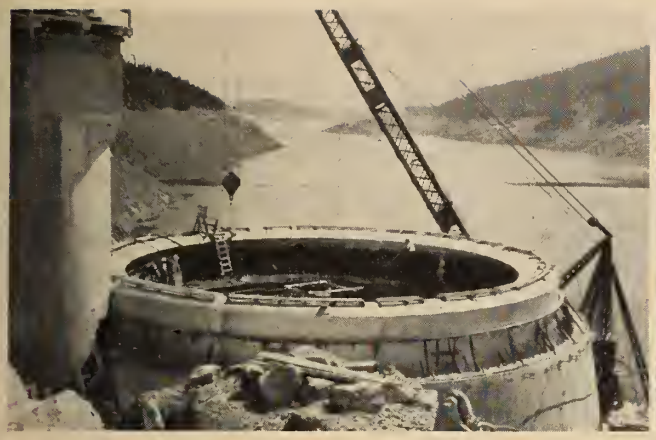
Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

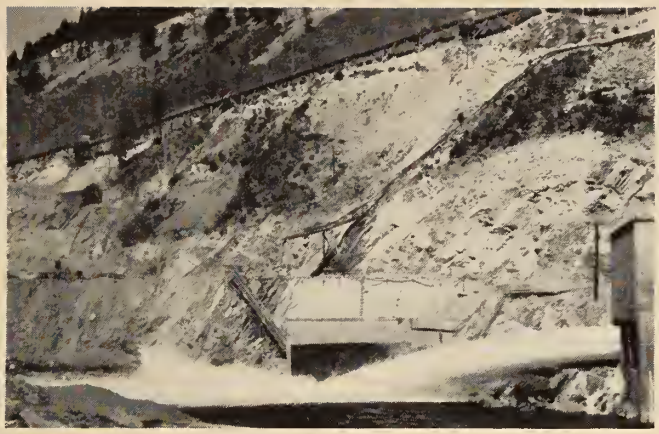
Field Trip

As guests of the Kalispell, Montana, Chamber of Commerce, a party of fifty-

Left. Upstream face of Hungry Horse Dam.
Right. Mr. Clark Mason, who arranged the field trip, photographed in front of the administration building.



Top of glory hole spillway.



Outlet conduit.

five members and their wives spent a very enjoyable weekend August 23 and 24. The highlight of the field trip was a visit to the Hungry Horse Dam which is situated on the South fork of the Flathead river, some 30 miles Northeast of Kalispell.

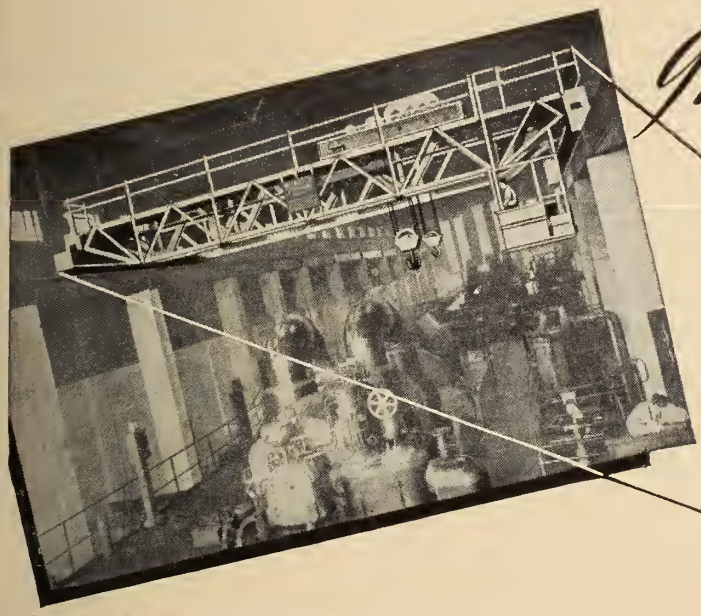
Transportation was provided in private automobiles, most parties travelling the 160 miles, via the Logan Pass, an excellent highway cut through the rugged and beautiful Glacier National Park.

Mr. Clark Mason, managing secretary of the Kalispell Chamber of Commerce handled all arrangements for the trip. The group enjoyed dinner in Kalispell at 6 p.m. August 23, after which they were taken on a 2 hour boat trip on Flathead Lake which is situated in the picturesque foothills south of Kalispell. In the evening the visitors were entertained in the Elks Lodge in Kalispell.

Following breakfast Sunday morning, the thirty-five engineers drove twenty miles to the administration building at Hungry Horse. From this point transportation was provided in a Bureau of Reclamation bus.

Mrs. Clark Mason entertained the ladies at a later breakfast and after breakfast they drove to the lookout point at the dam.

Mr. Jack Chiswell, public relations director for the project was the very genial and informative guide for the tour through the dam. The party was taken first via the lower construction road to the base of the dam and the



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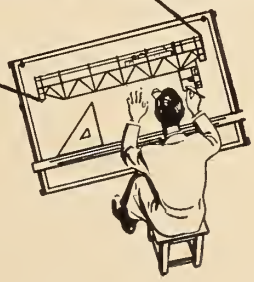

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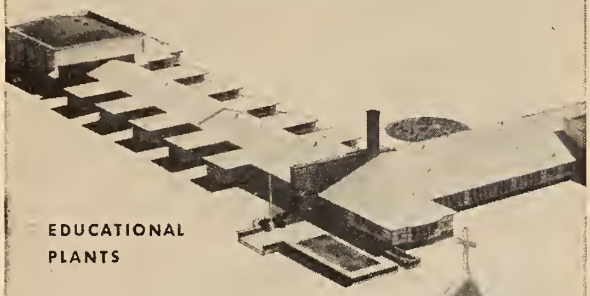

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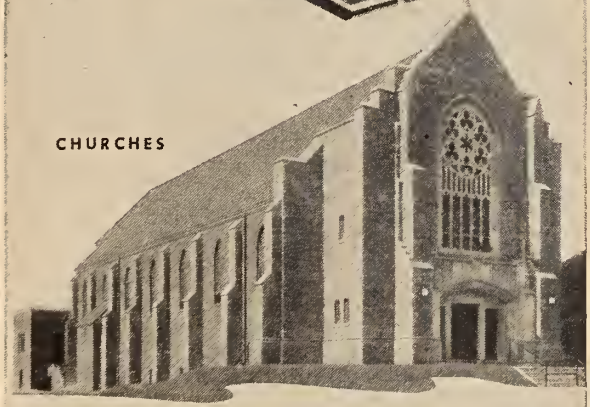

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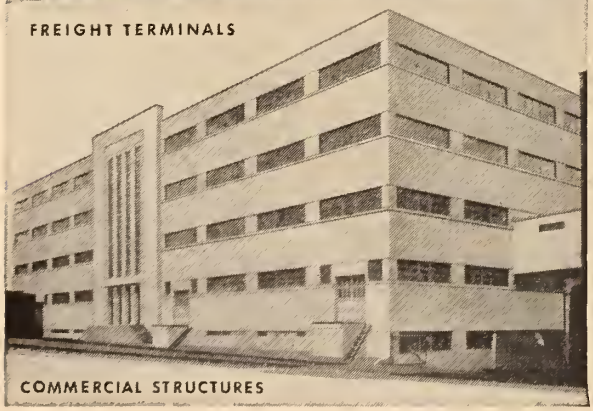

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powerhouse, where Mr. Chiswell covered the main construction features and electric generating equipment. When completed in 1953 the dam will be the fourth largest concrete and fifth highest dam in the world. The top of the dam is 520 ft. above bedrock, with a crest length of 2,100 ft. and arch radius of 1,200 ft.

The powerhouse, situated at the down stream toe of the dam, houses four single runner, Francis-type turbines of 105,000 hp. each, and four 71,250-kw. generators, giving the plant a total installed capacity of 285,000 kw. The maximum static head will be 487 ft. and the minimum, 255 ft.

Electrical installations were well underway at the date of the field trip, and one of the units had been given a running test August 23. Other units were under various stages of installation.

Each turbine under average head and load will require approximately 2,125 c.f.s. Three 8-ft. outlet conduits, each having a maximum discharge capacity of 4,500 c.f.s., together with the turbines will handle normal river flow at all times. Average flow over the past 17 years has been just under 3,000 c.f.s. Maximum recorded discharge was 46,200 c.f.s. in June, 1916.

Through controlled water flow the dam will allow the generation of an additional 300,000 kw. in downstream stations, making the total generating capacity of the undertaking nearly 600,000 kw.

During flood periods excess flow will be carried off in by a "glory hole" type spillway. The spillway is the highest one of its type in the world, and will have a discharge capacity of 53,000 c.f.s.

Elevators were not yet in operation, and upon completion of the inspection at the base of the dam the party was driven back to Hungry Horse and then by the upper road to the top of the dam. Here Mr. Chiswell covered the main features of the "glory hole" spillway, the concrete plant and the cable way system for placing concrete.

Capacity of the mixing plant is 400 cu. yd. of concrete per hour. All batching and mixing equipment is electrically operated and is controlled by a single operator from a combination control stand, scale dial and recorder cabinet. Portland cement, low alkali, and pozzalin (fly ash) are delivered by 880 cu. ft. semi trailers coupled to Euclid trucks via the upper road to the concrete plant. Aggregate is obtained from a natural river-run-deposit four miles downstream from the dam. Aggregate is trucked to the gravel processing plant and from this point is carried on a 1,600 ft. long conveyor belt system to the concrete plant, a vertical lift of 383 feet.

The cableway system for concrete placement consists of four cableways stretched between towers located high on the canyon walls. Three of the cableways are suspended between a 195 ft stationary head tower on the left abutment and three 52 ft. high movable tail towers which operate on 810 ft. long radial tracks on the right abutment. The fourth cableway is suspended between an 85 ft. high "A" frame stationary tail-tower on the right abutment, and a 100 ft. high movable headtower which operates on a 610 ft. long track on the left abutment. The four track cables are 3 inches in diameter and approximately 2,450 ft. long. The three cableways operating from the common headtower are designed for loads of 25 tons each and the fourth for a load of 20 tons.

The reservoir will be approximately 34 miles long and up to 3½ miles wide. Storage capacity will be 3,500,000 acre feet with a live storage of 3,455,000 acre feet for downstream power production and river regulation and 2,980,000 acre feet for at-site power production.

The completed dam, power house and spillway will require approximately 3,100,000 cu. yd. of concrete. Within the dam a system of galleries totalling 7,200 feet in length will provide for inspection, grouting, drainage and operation of appurtenant features. Concrete cooling control is accomplished by circulation of cold water through cooling coils embedded on the bottom of each 5 ft. lift of concrete. Direction of water flow is reversed each day to insure even cooling. Concrete placing temperatures average from 50 to 60 degrees F. and the maximum temperature rise is limited to 15 to 20 degrees F.

Mr. Somerville moved a vote of thanks to Mr. Mason and Mr. Chiswell and other officials and employees of the Bureau of Reclamation for the very enjoyable and educational trip.

Official photographer for the tour was Mr. A. L. H. Somerville, M.E.I.C.

This was the second field trip to the Hungry Horse Dam, the group having previously inspected the initial construction in 1950.

Toronto

H. M. Kolesar, Jr.E.I.C.,
Secretary-Treasurer

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

The Branch held its first meeting of the season on September 17th, when six important representatives of British engineering institutions visited Toronto. The exceptionally good attendance of members and visitors on this occasion included a number of former members of British engineering institutions now practising the various branches of the profession in Canada.

The meeting was held in the Mechanical Building, University of Toronto, and was opened by a few remarks from chairman of the Branch, W. H. Patterson. He introduced the distinguished visitors in whose honor the meeting had been arranged: Sir John Hacking, president, and W. K. Brasher, secretary, Institution of Electrical Engineers; Sir David Pye, president, and Brian G. Robbins, secretary, Institution of Mechanical Engineers; Mr. Allen Quartermain, president, and E. Graham Clark, secretary, Institution of Civil Engineers.

Mr. Allen Quartermain addressed the meeting in a general way, expressing his appreciation and that of his five colleagues for the kindness shown them in Canada by our Past President, Jim Vance. Mr. Quartermain paid tribute to the various engineering projects that he had seen during the day and spoke well of the subway construction now under way in Toronto. He explained that the purpose of the visit to this side of the Atlantic was to attend the Centenary of Engineering in Chicago.

Sir David Pye gave a short address on engineering research, particularly outlining the history of the jet engine, and illustrating the difficulties encountered financially and mechanically. Sir David was associated with the Department of Research at Cambridge

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University, England, at the time the jet engine was being investigated there by the inventor.

Sir John Hacking gave an outline of the progress made in Great Britain in power development since World War II, and brought his information right up to the present status.

He explained the local problems preventing use of large units for generation as in the U.S.A. Evidently the vast difference in coal value presents a boiler manufacturing problem. Sir John seemed to have his subject well in hand and it was very interesting.

Col. Grant, field secretary of the Institute, voicing the thanks of those present, remarked on the ease with which the speakers had presented their fine addresses despite the multitude of activities in Toronto.

At the close of the meeting the members of the various branches had the opportunity of meeting the presidents and secretaries of the British Institutions and were afforded an opportunity to meet with one another.

The branch executive entertained the visitors at lunch in Hart House, where Dr. Sidney Smith presided and expressed a very kind welcome to them. In the evening, prior to the meeting, an informal dinner took place at the Royal York Hotel.

In conclusion it would be quite proper to say that the visit of these gentlemen created a warm atmosphere and tended to reduce the distance between the two countries represented.

Vancouver

STUART S. LEFEAUX, M.E.I.C.,
Secretary-Treasurer

W. L. INGLIS, M.E.I.C.,
Branch News Editor

Field Trip

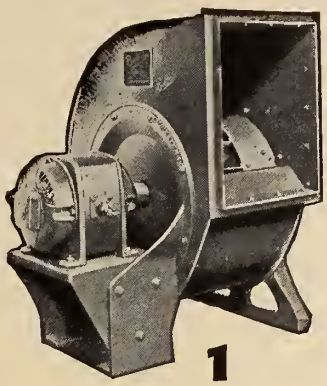
Thirty-five members of the Vancouver Branch and guests were present at an inspection of the Imperial Plant of the B.C. Packers Limited, Steveston, at the mouth of the Fraser River, on Wednesday afternoon, August 20th.

The Imperial Plant is considered the largest fish processing establishment in the British Commonwealth and an important part of British Columbia's 4th largest industry. Employees at the plant vary from 900 in summer to 400 in mid winter. Activities at the plant include the canning of salmon, herring, albacore tuna, clams, oysters; frozen and smoked fish, and the manufacture of edible meals, oils and fish solubles. The salmon cannery has a rated capacity of 9,500 cases in eight hours or approximately 230 tons of salmon.

The many operations observed by the party included the following:

Automatic trimming and cleaning, washing, can filling by machines and by hand, sealing, cooking, labelling and packing. The fresh fish department produces packaged fillets for sale from frozen food counters. The cold storage department has a capacity for storing 1,500 tons of fish at temperatures around 40° F. below zero.

After inspecting the plant the group were treated to refreshments which included many tasty fish products. Mr. Hugh Libby, vice chairman of the Vancouver Branch expressed the thanks for the group to Mr. K. Fraser, manager of B.C. Packers, Mr. Eric Turnill, superintendent of the Plant and to the guide Mr. Bill Payne for a most interesting visit.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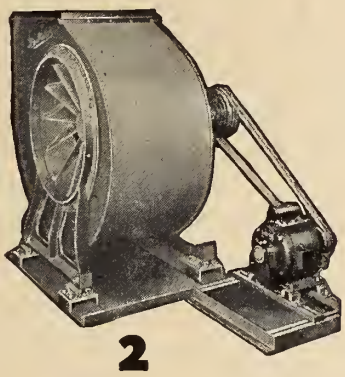
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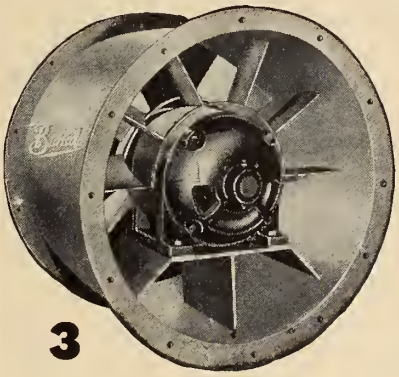
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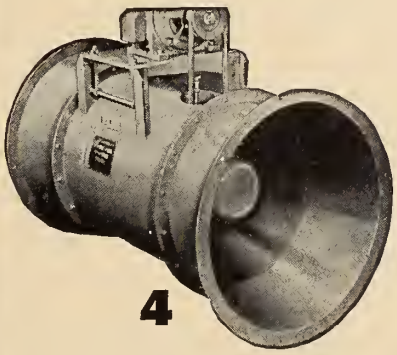
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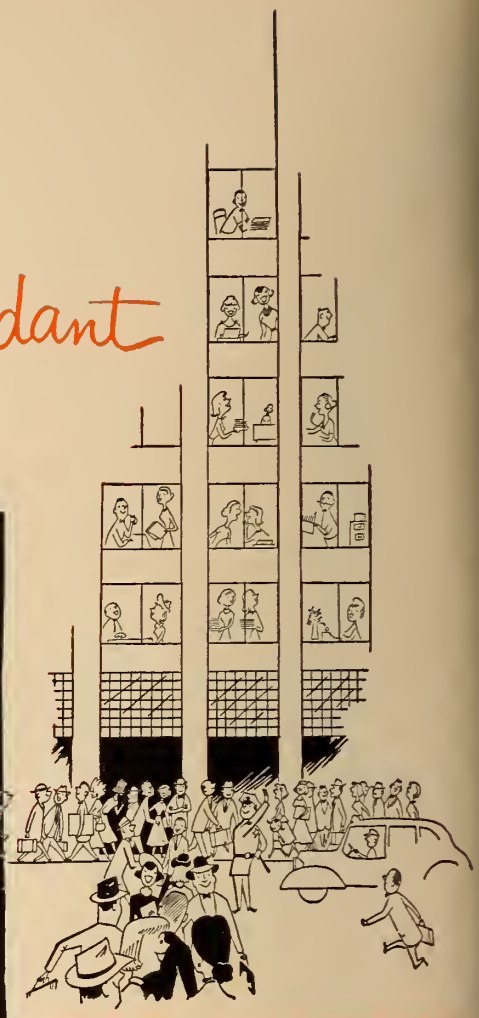

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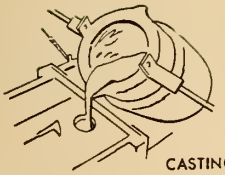

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

Civil engineering reference book, ed. E. H. Probst and J. Comrie. London, and Toronto, Butterworth, 1951. 1703 pp. illus. $22.00.

Besides the extraordinarily broad scope of this book, which includes every possible phase of civil engineering, what makes it rather uniquely valuable, is its international aspect. Contributing engineers and editors come from England, Austria, South Africa, Holland, Canada, United States and Switzerland, to mention just the obvious ones.

Subjects taken at random, which would not necessarily be expected in such a volume, include six pages on compressed air illness, the waterways regulations of various European countries, including navigable rivers, tides and tonnages; the basic principles for site investigation in any country; tables of live loads on bridges as applicable in the United Kingdom, United States, and Germany, and town planning information including types of street patterns, minimum street widths in Great Britain, and standards of the same for the United States and Canada. The value of these subjects treated is enhanced by the inclusion of copious bibliographies with each chapter.

Twenty pages of "Conversion and General tables", and fifty-five pages of general mathematical tables follow the text. The volume concludes with a name index, which includes the names of the authors of books included in the bibliographies, and thirty-eight pages of subject index. This book is a nearly must, or a complete must, to all our Civil members.

E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Canada 1952: the official handbook of present conditions and recent progress. Canada. Dominion bureau of statistics. Ottawa, the bureau, 1952. 312 pp., illus.

This handbook is planned to give a balanced picture of the general economic and social structure of Canada. The leading special articles in this edition deal with "Canada in the chemical age" and "Canada's defence program". Other topics covered are economic conditions, the people, the government, health and welfare, education, social and cultural relationships, national income, labour, transportation and communications, domestic and foreign trade. Production, manufactures and construction are dealt with at length. Hundreds of photographs, some in colour, illustrate all these subjects. The book contains a great many tables of statistics and is indexed.

Canadian trade index 1952. Canadian manufacturers' association. Toronto, the association, 1952. 1,102 pp., illus., $7.50.

This index contains two main sections. One is an alphabetical list of manufacturers, with addresses, branches, export representatives, trade marks, brands, etc. The other is an alphabetical list of products, giving, in each case, the names and addresses of manufacturers. A special export section is included in this book. It gives information on government services and aids in the development of export trade, financing, price quotations, foreign commercial representatives in Canada and export trade services and policy of the Canadian manufacturers' association. A directory of producers, shippers and exporters of agricultural produce and allied lines gives the names and addresses of forwarding agents, export and import houses, etc. An alphabetical list, in French, with parallel English, of the headings in the product list may be useful to the French-speaking user.

Electrical engineering: theory and practice. W. H. Erickson and N. H. Bryant. New York, Wiley, c1952. 523 pp., diags., $7.50. (Canada)

This book has been developed from a sequence of courses given to mechanical, civil and chemical engineering students. The topics covered may be grouped into three general categories — circuits, machines and electronics — according to the order of presentation. Wherever possible, basic relations are introduced in a general form before being applied to either d-c or a-c circuits. In addition to the ordinary d-c and a-c machinery, the theory and application of synchro units and rotating amplifiers are discussed. In presenting the theory, emphasis is placed upon those

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By M. Knoll, Princeton University, and B. Kazan, R.C.A. Laboratories Division. Storage tubes discussed in terms of their common technical characteristics; their methods of operation are separated and classified in terms of fundamental processes. 1952. 143 pages. $3.60.

PRINCIPLES OF HUMAN RELATIONS
Applications to Management

By Norman R. F. Maier, University of Michigan. Now leaders on all levels of industry can effectively influence the men under them, and be trained to use these new tested and proved management techniques. 1952. 474 pages. Illustrated. $7.20.

HIGHWAY CURVES (4th Edition)

By the late Howard Chapin Ives. New 4th Edition by Phillip Kissam, Princeton University. The theory and practice of highway curves; a mine of valuable information on highway surveying, location, geometric design, field procedure and earthwork. 1952. 369 pages. $8.40.

ESSENTIALS OF MICROWAVES

By Robert B. Muchmore, Hughes Aircraft Co. Fundamental empirical laws that govern wave propagation and reflection; wave guides, resonators, etc., and applications of microwave equipment. All interpreted, described and judged on the basis of measurements that can be made. 1952. 236 pages. $5.40.

STATISTICAL THEORY
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By A. Hald, University of Copenhagen. Presents a large part of the statistical theory which has been developed during the past fifty years and proven to be of practical value. Illustrated examples from engineering and industrial practice. 1952. 783 pages. $10.80 . . . *Plus* **STATISTICAL TABLES AND FORMULAS.** A survey of all the formulas of practical importance given in above book. Also includes tables for use in connection with these formulas. 1952. 97 pages. $3.00.

FUNDAMENTALS OF
ENGINEERING ELECTRONICS (2nd Edition)

By William G. Dow, University of Michigan. Fundamentals of charged-particle behaviour. This new 2nd Edition is completely revised and brought up to date, with the MKS system of units employed throughout. 1952. 626 pages. $10.20.

THEORY OF ELASTICITY AND PLASTICITY

By the late H. M. Westergaard. Contains the essential definitions and underlying concepts—with a complete but concise history of the subject and a wealth of valuable reference material. 1952. 176 pages. $6.00.

IMPERFECTIONS IN
NEARLY PERFECT CRYSTALS

Edited by William Shockley, Bell Telephone Laboratories. 20 leading scientists summarize current knowledge of the field in this NRC Symposium volume. 1952. 490 pages. $9.00.

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factors that further intelligent application or selection of equipment; little stress is placed upon design details. Although mathematical analysis of the operation of circuits and machines is not avoided, physical analysis has been given more importance. The problems at the ends of the chapters are, for the most part, of a practical nature. Necessary diagrams and an index have been provided.

The engineering and industrial catalogue, 7th ed., 1951-1952. Toronto, Canadian engineering publications, 1952. 501 pp., illus.

The two main sections of this catalogue are a products index and a directory of manufacturers. In the products index, under the heading of each product are given the names of firms manufacturing that particular item. In the directory are given the names and addresses of firms mentioned in the products index and of firms acting as their sales representatives in Canada, with the addresses of branch offices and other related data in each case. Advertisements are divided in a catalogue giving descriptive data on equipment, materials and services, a professional directory giving the cards and a classified index of consulting engineers and architects, an engineering services directory giving the cards and a classified index of engineering contractors, inspection companies, etc.

Frost action in soils: a symposium. United States. Highway research board. Washington, the board, 1952. 385 pp., illus., $4.40. (Canada)

This is a symposium of thirty-nine papers on frost action in soils. Of the three papers on climate and distribution of soil, the first relates to soil profiles, while the second is on climatic aspects of frost heave and the third discusses climatic and geographical data. In the group on soil temperature and thermal properties of soils we find a paper on field measurements of soil temperature in Indiana, a paper on thermal conductivity and diffusivity of soils, and a paper on thermal conductivity probe. Follows a group of fifteen papers prepared by the subcommittee on soil moisture and moisture movements. Several of these deal with methods of measuring moisture content. Eight papers on basic data pertaining to frost action cover a wide range of subject matter. Other papers presented under the heading "Frost action and spring breakup", "Remedies and treatments" and "Needed research" contain a great deal of important information.

Articles are illustrated through photographs and diagrams, and often contain tables and graphs. Each one is accompanied by a list of references.

Great Britain. Department of scientific and industrial research. Report for the year 1950-1951. London, H.M.S.O., 1952. 271 pp., 7/6.

This publication contains the reports, as to expenditures, staff, grants, etc., of the advisory council and of the privy council. A summary of work gives an idea of the work done by the department on building research, fire research, food investigation, forest products research, fuel research, geological survey, hydraulics, mechanical engineering, pest infestation, radio, road and water pollution research. An important section surveys the accomplishments and work in progress of over forty British research associations. Appendices contain a list of publications issued during the year, a summary of expenditure, a list of research associations, and other related information. They are followed by an index.

Harwell: the British atomic energy research establishment 1946-1951. Great Britain, Ministry of supply and Central office of information. London, H.M.S.O., Ottawa, United Kingdom information office, 1952. 128 pp., illus., 6/–.

The purpose of this publication is to present to the general reader a connected story of the work and problems of the Atomic energy research establishment at Harwell from its inception in 1946 to the end of 1951. Chapters deal with the origin and organization of the establishment, the programmes of work, the production programme, the isotope programme, the reactor programme, the accelerator programme, the protection of health and the detection of radiation, fundamental research work and extramural relations. Appendices give a list of the senior staff, information on the Harwell reactors, a list of scientific papers by the staff, a reading list and a glossary. Many photographs and an index are included.

Horner's dictionary of mechanical engineering terms. Part 1: Modern terms; part 2: General and traditional terms. Originally compiled by J. G. Horner, 7th ed. revised and enlarged by Staton Abbey. London, Technical press, 1952. 121, 417 pp., 22/6.

This is a comprehensive dictionary of the general and traditional terms used by draughtsmen, pattern-makers, moulders, smiths, boiler-makers, fitters, turners, erectors and engineering storekeepers. In this condensed encyclopedia of mechanical engineering, the practical aspects are as strongly represented as the theoretical. It contains an appendix which has been completely revised and greatly enlarged by the inclusion of terms which have come into use during recent years. The body of the dictionary has been thoroughly revised, but many of the older terms, which are in danger of dying out in these days of mechanized production, have been retained as forming inseparable links with traditional craftsmanship.

Human relations in supervision: leadership in management. W. E. Parker. 1st. ed. New York, McGraw-Hill, 1951. 472 pp., illus., $6.25.

As different people in all parts of the globe, whether distant, or close at hand, differ in skin pigmentation, colour of eyes, hair, aptitudes, or mental and physical capabilities, so in the same way do individuals differ in their reactions to given situations, or to demands on their physical or mental faculties.

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A list of motion pictures and filmstrips and an alphabetical index further enhance this most practical volume.

Hutchinson's pocket technical encyclopedia. L. E. C. Hughes and J. P. Bremner comp. London, Hutchinson's, Toronto, Ryerson, 1952. 182 pp., $1.75.

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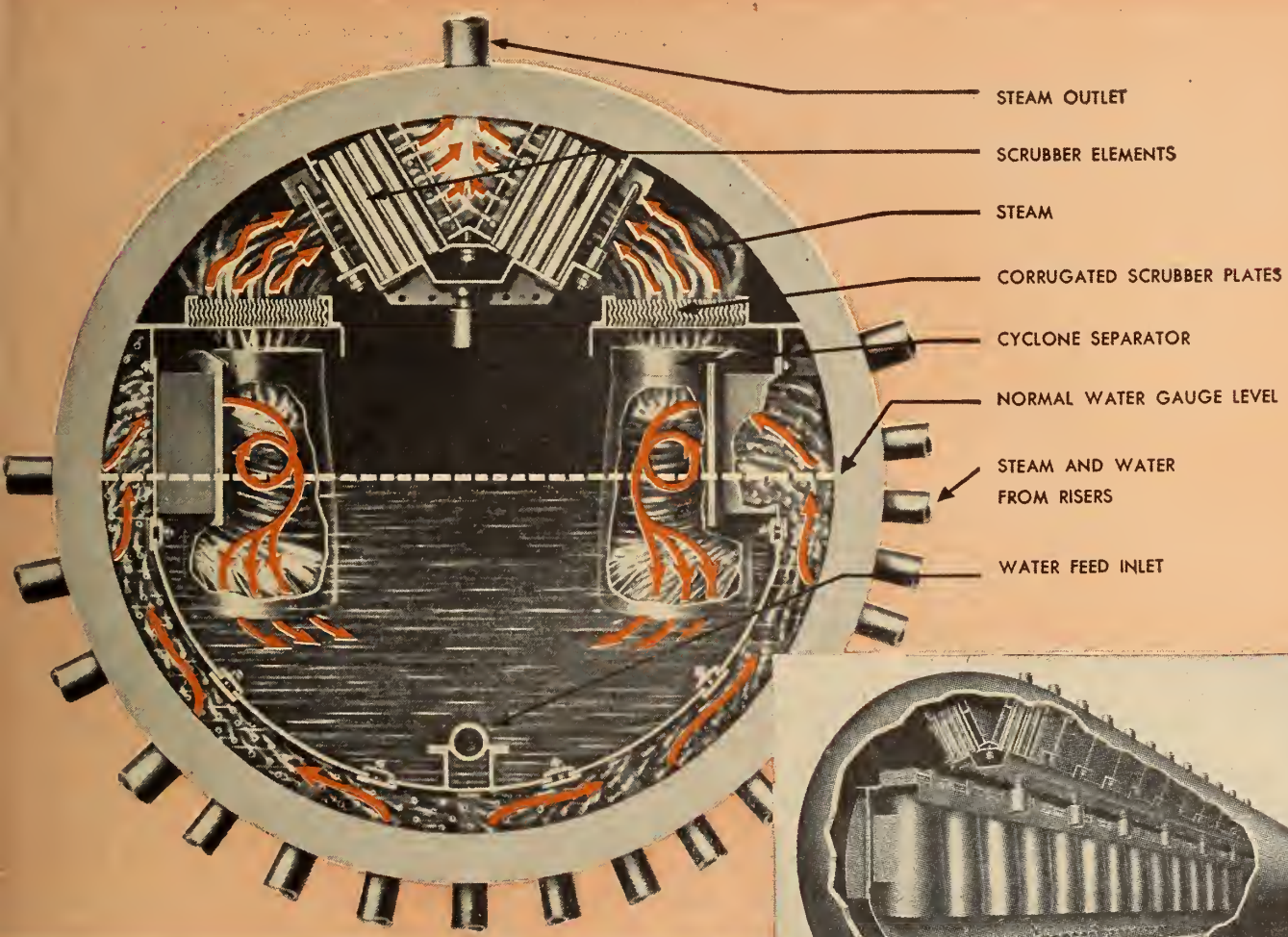

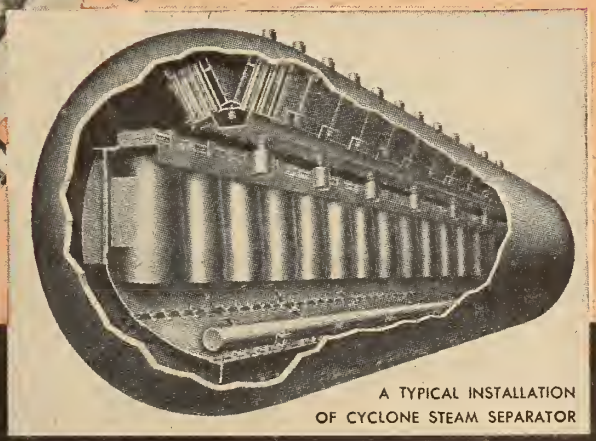

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The entries in this pocket encyclopedia have been largely based on Hutchinson's four-volume Technical and scientific encyclopedia (1936) and Twentieth century encyclopedia (1948). The compilers make no claim to finality or completeness; however, the short answer, which is the feature of this book, often suffices. On the other hand, a great many subjects have been included, which one would not expect to find in such a small technical encyclopedia: subjects such as positivism, post-impressionism, pragmatism, punch, etc. Although not illustrated, the present work is, in pocket-size, a mine of useful technieal, scientific and para-scientific information.

I E S Lighting handbook: the standard lighting guide, 2nd ed. N.Y., IES, 1952. illus., irregular paging, $10.00.

Showing a fifteen per cent increase in material, and a seventy-five per cent revision over the nineteen hundred and forty-seven edition, this new lighting handbook has been in preparation for over two years. It is the result of the extensive planning and collaboration of thirty-four technical committees, comprising nearly five hundred members of the society, along with the Society of motion picture and television engineers; Society of automotive engineers; the American society of heating and ventilating engineers, and the National electric sign association.

The information is presented in as nontechnical a manner as possible, thereby considerably broadening the scope of its usefulness. It has a twenty-four page index, and is well illustrated.

Kempe's engineer's year-book, 1952. London, Morgan, 1952. Two volumes, volume 1, 1,467 pp.; volume 2, 1,440 pp., illus., 71/6.

A note of introduction or of review of this well-known handbook is scarcely necessary. All we are doing is announcing the fact that the new Kempe is in the library, that we find the sections on electrical engineering and fuels have been considerably revised; new diagrams and illustrations have been added to Railway Engineering, and the chapter on Timber deals also with plywood. Also, the editors have thoroughly gone over and expanded the index.

Management controls in industrial research organizations. R. N. Anthony. Boston, Harvard university, Graduate school of business administration, 1952. 537 pp., tables, $8.10. (Canada)

Written primarily for persons in management control in scientific research organizations, this volume is a study of the best methods of control action for research workers in particular. Recognizing that research activity differs greatly from other activities of an industrial firm, and that success in research depends largely on the freedom of the research worker, Dr. Anthony is trying to find the proper balance between "freedom of the laboratory level and direction at the top".

He considers general and specific control methods and problems and then those probably particularly specific to research workers, including budget, types of expenditures, locations, and even personalities.

This book well merits the attention of all of you in any way connected with industrial research.

Newfoundland who's who, 1952. St. John's, Newfoundland Who's Who, 1952. 102 pp., illus., $2.50.

One hundred and ninety-seven Newfoundland residents are included in this volume, each one accompanied by a portrait. Readers will be surprised to find relatively important Newfoundlanders omitted, until one realizes that, except for obviously outstanding personages, inclusion is paid for by the biographee. Still it is a handy little volume for people concerned with that section of our country.

Public speaking for businessmen. W. G. Hoffman. 3rd. ed. Toronto, McGraw-Hill, 1949. 412 pp., $5.65.

There seems to have been quite a vogue recently for books on public speaking. Perhaps the reason for their popularity is somehow tied up with to-day's emphasis on personnel and labour relations, or psychology and making friends and influencing people, or getting rid of our inhibitions, or even trying to persuade ourselves that many of the people around us are certainly as shy, and often more so, than we, and therefore we should speak first, to put them at their ease.

Well, whatever the reason is behind it, the trend is evident in the countless books of this type which have come out in the past couple of years, some of them run of the mill, some not worth serious consideration, and some meriting attention. In this latter category we would place Mr. Hoffman's book. All aspects of the problem, from approaching the whole subject of making a speech, to sample speeches to illustrate points presented in the text, are included, and the book is indexed.

A close examination reveals a complete absence of direction on how to arrange the facial muscles for television. No doubt the next edition will remedy this.

In the meantime, we suggest it would be a most valuable addition to either the home or the office bookshelf.

Pull's workshop practice: a practical text book, 9th ed. Rev. by P. S. Houghton. London, technical press, 1952. 739 pp., illus., 24/–.

The information contained in this book is given in clear short paragraphs, with definitions and illustrations wherever needed. A chapter is devoted to each of the following subjects: measurements and measuring machines; measuring tools; gauges and gauge systems; common workshop tools; bench work; materials; wrought iron and steel; heat treatment; lathes; tool holders; lathe tools, speeds and feeds; lathe accessories; turning; screws and screw cutting; capstan and turret lathes; capstan and turret lathe tools; plain and universal milling; gears and gear cutting; gear-hobbing and planing machines; boring and slotting machines; planing, shaping and drilling; plain and universal grinding; drop forging and stamping; welding. The illustrations are drawings, diagrams and photographs. Many tables and an index have been included.

Statistical tables and formulas. A. Hald. New York, Wiley, London, Chapman, c1952. 97 pp., $3.00. (Canada).

This is a revised version of the appendix of the author's Danish textbook on statistics published in 1948 but still untranslated into English. A survey of the most important formulas given in the textbook is presented, and tables for use in connection with these formulas are given. The principles used for tabulating the distributions are those of R. A. Fisher. The tables contain 21 fractiles for the t–, x^2–, and W– distributions, and 17 for the v^2– distribution, representing an extension of previously published tables. Linear interpolation both with respect to probability level and number of degrees

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Who's who in commerce and industry, 7th inter. ed. A. N. Marquis co. Chicago, the company, 1951. 1,355 pp., $12.00.

This publication contains the biographies of persons either of special prominence in their particular branch of business or holding important positions in commercial and industrial concerns. People in the first class are those so identified with affairs of commerce and industry as to be subject to wide inquiry or discussion, while people in the second class are principals of firms (mostly American) of important size or product interest. Usual biographical information is given concerning birth, education, positions held, clubs, address. Whenever possible, the business address is included. At the end of the book, an extensive list of companies is given, with coded references to biographies of people who are or have been connected with them. Although this compilation pretends to be international, it is obviously for the use of American people and most biographies are American or bear English names.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Handbook of engineering fundamentals. O. Eshbach, editor. New York, Wiley, second edition, 1952. Various paging, illus., $12.50. (Canada)

This companion volume to the specialized handbooks of the "Wiley engineering handbook series" contains the fundamental laws, theories, and data which are basic to engineering practice. The revision consists of deletions, additions, and changes indicated by sixteen years experience with the first edition, one significant aspect being the much greater emphasis on the use of the MKS system of units. The subject matter is essentially an extended summary of the principles of mathematics, physics and chemistry, the commonly used mathematical tables, the properties and uses of materials, and the mechanics of solids and fluids. A discussion of engineering law is included.

The scientific papers of James Clerk Maxwell. Edited by W. D. Niven. New York, Dover Publications, n.d. 607 pp, 806 pp., illus., two volumes bound in one. $12.50 (Canada)

This reprint of the definitive edition of 1890 contains all the published papers, lectures and addresses, essays, and short treatises of one of the great theoretical physicists of the 19th century. These clear and vigorous expositions of fundamental physical theory and experiment cover a broad range of subject matter and are still useful to the student or physical investigators.

Statistical theory with engineering applications. A. Hald. New York, Wiley, 1952. 783 pp., charts, tables, $11.25. (Canada)

The author's aim has been to cover a large part of the theory developed during the past fifty years and proved to be of practical value. The subject is treated necessarily from a mathematical standpoint, but each important theorem or aspect is illustrated with examples from actual experience. The main stress is laid on the normal distribution and the tests of significance connected with it.

STANDARDS

British Standards, British standards institution, 24/28 Victoria street, Westminster, London, S.W.1. British standards are available from the Canadian standards association, National research building, Ottawa, Canada.

B.S. 1858:1952 — Bituminous-base filling compounds for electrical purposes. 6/–.

This standard applies to bituminou compounds which may be subjected to electrical stresses in service, either in electrical apparatus or in cable boxes. The compounds dealt with are classified according to their softening points; electrical and physical properties are specified and full details are given of the tests required to determine these properties.

B.S. 1866: 1952 — Solid drawn copper-silicon tubes for general purposes. 2/–.

The present work gives the chemical composition and mechanical properties of solid drawn copper-silicon tubes. It includes details of making the mechanical tests and a mercurous nitrate test. Tolerances on width, length and thickness are tabulated.

B.S. 1867: 1952 — Solid drawn aluminium bronze tubes for general purposes (7 per cent aluminium). 2/6.

The standard gives the chemical composition and mechanical properties and includes details of making the mechanical tests and a mercurous nitrate test. Tolerances on width, length and thickness are tabulated.

British standards institution yearbook 1952. London, the institution, 1952. 459 pp., 7/6.

This yearbook is mainly a list of British standards giving, for each one, a description and a short review. It also contains information on the Institution such as its aims and objects, subscribing membership, library, Manchester office, membership of councils and committees, principal officials, work in hand and reference sets of British standards in the United Kingdom and other countries.

Underwriters' laboratories of Canada. Standards. Underwriters' laboratories of Canada, 340 Richmond St. West, Toronto.

Subject 7(B): 1950 — 2 imp. (2½ U.S.) gallon foam extinguishers.

This standard states minimum requirements as to materials and assembly of shell, collar, cap, gasket, outlet elbow, outlet screen, coating, handles, inner solution container, stopple, hose, coupling, nozzle and safety release device. Charging,

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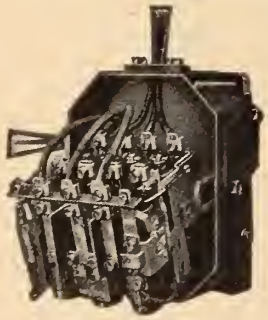

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operating, testing, inspection and marking are also covered.

Subject 7(C): 1950 — 2-gallon (2½ U.S. gal.) loose stopple soda-acid extinguishers.

Materials and assembly of parts, as well as charging, operating, testing, inspection and marking are dealt with as in Subject 7(B).

Subject 7(E): 1950 — Five gallon hand pump fire extinguishers.

The tank of this extinguisher has a capacity of 5 U.S. gallons (231 cubic inches per gallon) when filled to within 1½ inches of the top. The pump is capable of throwing a practically continuous stream from a ⅛ inch nozzle for a distance of 30 to 40 feet. The mechanism of the pump is covered in details.

Subject 10(a): 1951 — Tin-clad fire doors and shutters.

A door or shutter conforming to these specifications consists essentially of a core made up of layers of boards nailed to each other, encased in terne or zinc plates jointed together at their edges and nailed through the seams to the core. Detailed recommendations are given for construction and inspection, as well as standard methods for the determination of weight and composition of coatings and for the copper sulphate test of zinc-coated steel sheet.

Subject 18: 1950 — Unlined fire hose.

These requirements cover unlined fire hose in the 1¼, 1½, 2 and 2½ in. sizes. The hose consists of a fabric tube made of flax fiber yarn of such nature that the threads swell shortly after being wet. General requirements as to material, construction, workmanship and methods of examination, inspection and test are given.

Subject 19: 1950 — Cotton rubber-lined fire hose for public and private department use.

The requirements apply to the trade sizes of 1½, 2, 2½, 3 and 3½ in. single or multiple-jacketed cotton, rubber-lined fire hose for use in public or private fire departments. General requirements are made as in Subject 18.

Subject 42: 1951 — Hand-fire extinguishers, vaporizing liquid type (Sizes under 1 Imp. Gal.)

This short standard covers design, operation, construction of seal, marking, durability, fire control provided and composition and properties of the liquid.

Subject 58: 1950 — Underground storage tanks.

This standard covers the construction and performance of underground storage tanks to be employed for the storage without pressure, of flammable liquids, such as gasoline, kerosene, fuel oil and naphtha. These tanks are either horizontal or vertical cone-bottom. Capacities, sizes, materials, joints, pipe connections, manholes, painting, marking, etc., are dealt with.

Subject 80: 1950 — Inside storage tanks for oil burners.

This applies to steel tanks, of capacities of 250 Imperial gallons and less, intended for use in basements of buildings for the storage and supply of oil fuels for oil burners. Paragraphs cover size and form, material and thickness, heads and seams, pipe connections, factory test, coating, preparation for shipment and design test of assembly.

Subject 142: 1922 — Horizontal and vertical above-ground storage tanks for hazardous liquids.

These specifications are concerned only with cylindrical tanks of a size that can be completely assembled and tested at the factory before shipment. These tanks are intended for the storage of hazardous liquids not normally under pressure and are not to be used in connection with pressure system. Capacity, dimensions, material, connections, manholes, tests, marking, etc., are dealt with.

Subject 448: 1951 — Centrifugal fire pumps.

This standard allows the use of either the horizontal-shaft or the vertical-shaft type, in the single-stage or multi-stage patterns. Performance, design and construction, equipment and accessories are covered in detail.

BOOKS RECEIVED

Annual report on the progress of rubber technology, Vol. 15, 1951. T. J. Drakeley ed. London, Institution of the Rubber industry, 1951. 135 pp., £1.1.0.

Automatic record changer service manual, including latest multi-speed changers, wire and tape recorders. Vol. 4, 1951-52. Howard W. Sams & Co. Indianapolis, the company, 1952. Illus., $3.00.

A bibliographical survey of flow through orifices and parallel-throated nozzles. T. H. Redding. London, Chapman, c1952. 196 pp., 32/6. (B.S.I.R.A. research publication M.9).

Building and public works administration, estimating and costing for the use of civil engineers, surveyors, and building contractors. Spence Geddes, 4th ed. London, Newnes, Toronto, British book service, c1952. 291 pp., illus., $7.00 (Canada).

CCH Canadian income tax act, consolidated to adjournment of parliament, 1952. CCH Canadian limited. Toronto, the company, 1952. 348 pp., $2.50.

The cold working of non-ferrous metals and alloys: a symposium on metallurgical aspects of the subject held in London on the occasion of the annual general meeting of the Institute, 14 March 1951. Institute of Metals. London, the Institute, 1952. 207 pp., illus., 15/–. (Institute of metals Monograph and Report series No. 12).

Dictionary of architecture. H. H. Saylor. New York, Wiley, c1952. 221 pp. Includes 16 illustrations and plates. $5.63. (Canada)

Die casting: the die casting process and its application in modern manufacture. 2nd ed. C. O. Herb. New York, Industrial press, c1952. 310 pp., illus., $6.00. (Canada)

The electromagnetic field. Max Mason and Warren Weaver. New York, Dover, c1929. 389 pp., illus., paper. $2.30, cl. $4.95. (Canada)

Electronic valves, Book 5: Application of the electronic valve in radio receivers and amplifiers, Volume 2: A. F. Amplification — The output stage — Power supply. B. G. Dammers and others. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1951. 431 pp., illus., $7.75. (Canada)

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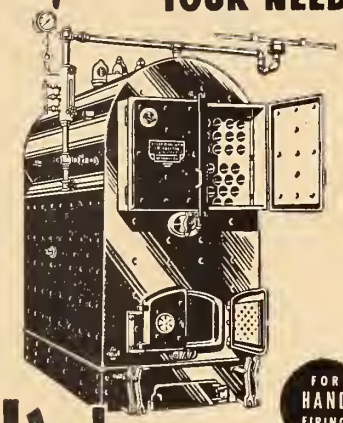

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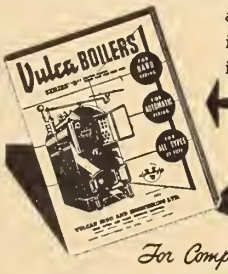

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Electronic valves, Book 7: Transmitting valves: the use of pentodes, tetrodes and triodes in transmitter circuits. J. P. Heyboer, P. Zijlstra rev. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1951. 284 pp., illus., $6.25. (Canada)

Elements of statistics. C. F. Lambe. Toronto, Longmans, c1952. 112 pp., $1.55.

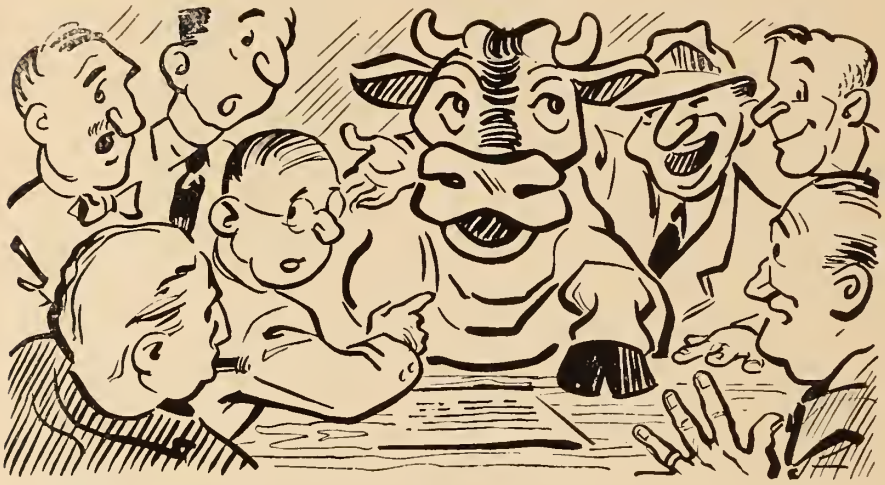
Engineering in public health. H. E. Babbitt. Toronto, McGraw-Hill, 1952. 582 pp., illus., $10.00.

Estimating for building and civil engineering works, for the use of builders, public works contractors, architects, civil engineers and surveyors. Spence Geddes. London, Newnes, Toronto, British book service, c1951. 472 pp., tables, $12.75.

Handbook of heating, ventilating and air conditioning. 3rd ed. John Porges. London, Newnes, Toronto, British book service, c1952. Illus., $5.00.

Industrial waste treatment. E. B. Besselievre. Toronto, McGraw-Hill, 1952. 391 pp., illus., $8.75.

Manual of foreign languages for the use of librarians, bibliographers, research workers, editors, translators and printers, 4th ed. rev. and enl. F. G. von Ostermann. New York, Central book company, 1952. 414 pp., $15.00 (Canada).



THE COW
at the council table

The Reeve and Council were startled, but Jim explained.

"Lactic acid from spilled milk is playing heck with my barn floor. I've brought Bessie along to bear me out."

"Moo-oo-oo!" said Bessie, meaning "You're darn right."
"Battery acid is doing the same to my floor,"
said Bob Harris, the garage owner.

It turned out that Tom Black, the photographer, Bill Short of the cooperative packing plant, Harry Smith, the laundry proprietor, Elmer Park of the sheet metal works, were all having acid trouble, too.

"Guess we were smart to put in Vitrified Clay Pipe for our town sewerage system," said the Reeve. "No trouble with acids or corrosive waste there! Vitrified Clay Pipe gives *permanent* protection, because it's bonded by fire, inside and out. Good investment that was, eh, Jim?"
"Moo-oo-oo!" said Bessie, meaning "You bet your life!"

VITRIFIED CLAY PIPE INDUSTRY
BONDED BY FIRE

7-2

Metallurgy for engineers. John Wulff and others. New York, Wiley, c1952. 624 pp., illus., $8.10. (Canada)

Mechanics of the gyroscope: the dynamics of rotation. R. C. Deimel. New York, Dover, c1950. 192 pp., illus., paper ed. $2.00, cloth. $3.75. (Canada)

Numerical methods in engineering. M. G. Salvadori and M. L. Baron. New York, Prentice-Hall, 1952. 258 pp., illus., $8.25. (Canada)

Optics, or a treatise of the reflections, refractions, inflections and colours of light, based on the 4th ed., London, 1730, with a foreword by Albert Einstein. Isaac Newton. New York, Dover, c1952. 406 pp., illus., paper ed. $2.40, cloth $4.95. (Canada)

Pattern design, 2nd ed. H. E. Kiley and J. H. Paustian. Scranton, Penna., International textbook co., Laurel publishers, c1952. 193 pp., illus., $5.75. (Canada)

Practical radiography for industry. H. R. Clauser. New York, Reinhold, 1952. 301 pp., illus., $9.15. (Canada)

Prestressed concrete structures. A. E. Komendant. Toronto, McGraw-Hill, 1952. 261 pp., illus., $7.50.

The pulp and paper manual of Canada 1952, 12th ed. National business publications ltd. Gardenvale, the company, 1952. 444 pp., illus., $3.00.

The Quebec bridge 1908-1918: Report of the government board of engineers, 2 vol. Canada, department of railways and canals. Ottawa, the department, 1919. Vol. 1: 259 pp., illus. Vol. 2: 111 plates. $1.00.

Reinforced concrete (Architectural and building series). Oscar Faber. London, Spon, Toronto, British book service, 1952. 232 and 55 pp., illus., $6.00. (Canada)

Science in Alaska: selected papers of the Alaskan science conference of the National academy of science, National research council, Washington, November 9-11, 1950. H. B. Collins ed. Arctic institute of North America. Washington, the institute, 1952. 305 pp., illus., $2.25. (Special publication No. 1).

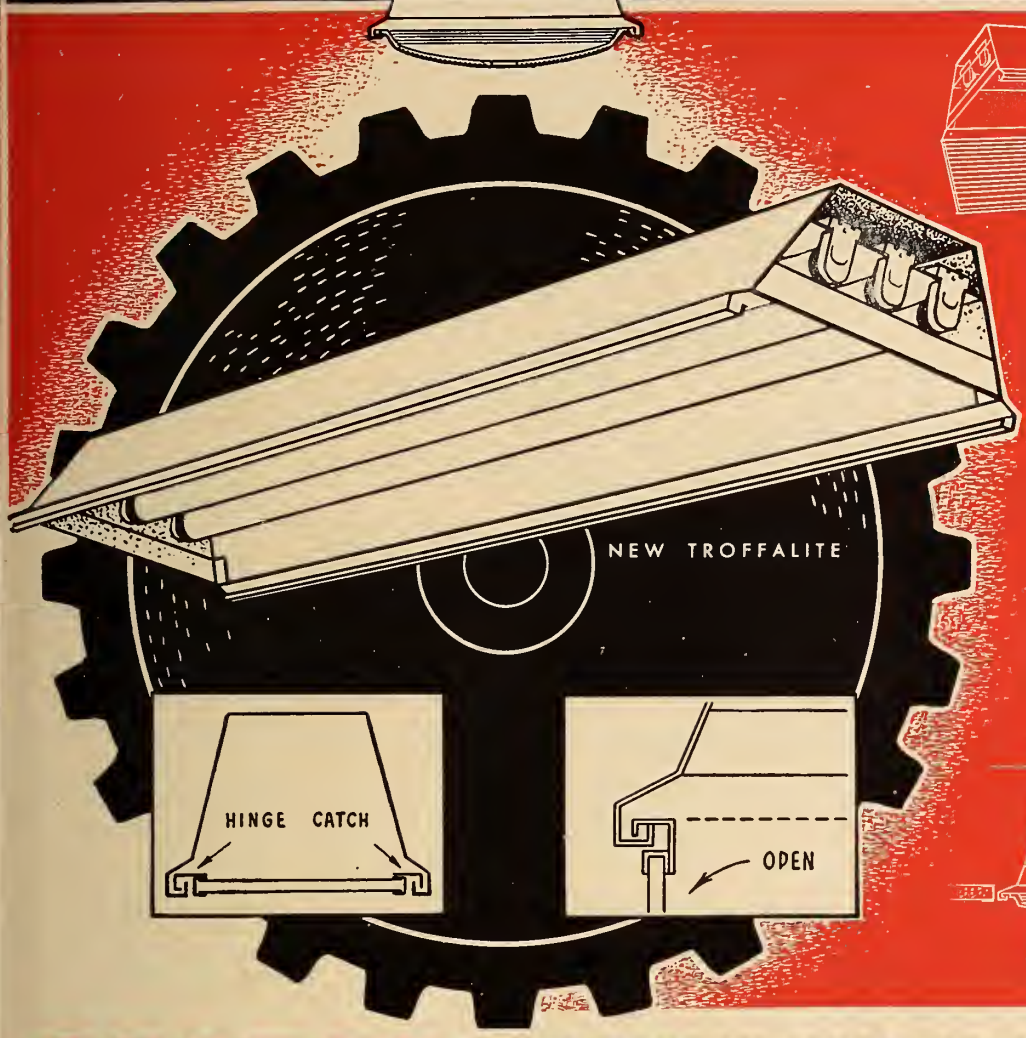
Techniques of plant maintenance 1952: proceedings of the technical sessions (sponsored by the American society of mechanical engineers and the Society for the advancement of management) held concurrently with the Third plant maintenance show, Philadelphia, January, 1952. New York, Clapp & Poliak, 1952. 182 pp., $7.20. (Canada)

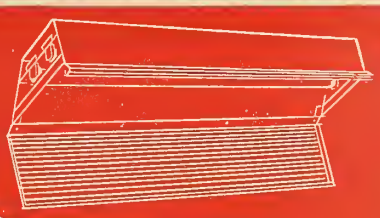
TECHNICAL BULLETINS RECEIVED

American water works association. Tentative specifications:
No. B201-51T — Soda ash.

Bell telephone system. Monographs:
No. 1937 — Mechanics of discrete polymer molecules, by W. O. Baker and others. No. 1938 — the copper oxide rectifier, by W. H. Brattain. No. 1939 — A portable direct-reading microwave generator, by E. L. Chinnock. No. 1940 — The quantum theory, by K. K. Darrow. No. 1941 — Test methods for cracking sensitivity of polyethylene, by W. C

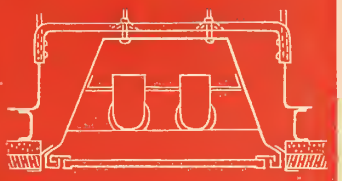
WILSON LIGHTING
FROM INVISIBLE FIXTURES





Showing panel down for easy maintenance.

Showing T-bar installation and egg-crate louvre.



Showing standard steel channel and recessing hanger.

Showing plaster installation using side plaster strips and Corning glass lens.

GEARED TO CANADA'S GREAT BUSINESS EXPANSION

The New Troffalite—featuring the exclusive Wilson HINGELESS "HINGE" FRAME

Here's a recessed fluorescent light fixture, engineered for efficiency . . . designed for modern appearance . . . versatile in action . . . unsurpassed in light distribution.

The New Troffalite is available in 2 and 3-lamp standard 40-watt, 4′ and 6′ Slimline and the new 85-watt 5′ lamp. There is a choice of open type, louvre, or various glass panels, all mounted in Wilson's unique Hingeless "Hinge" Frame, as illustrated above.

For a smooth, unbroken surface of ceiling and lighting at its best, specify the new Wilson *Troffalite.*

For complete data write for Catalogue, Section No. 1.

"*THE* NAME IN CANADIAN LIGHTING"

J. A. WILSON LIGHTING & DISPLAY LTD.

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OFFICES & SHOWROOMS IN TORONTO & MONTREAL, REPRESENTATIVES IN MARITIMES, WESTERN CANADA & B.C.

How to move or add lights anywhere, anytime without costly rewiring

BullDog Universal Trol-E-Duct provides a continuous outlet, completely flexible lighting

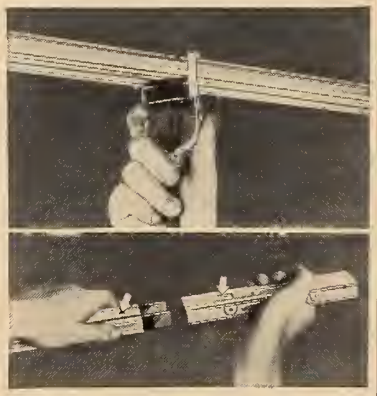
Safe, simple, quick! Top off power from totally enclosed bus bars at any point along the continuously slotted duct with handy trolleys or twist-out plugs. Universal Trol-E-Duct both supports and supplies current to these fluorescent lighting fixtures.

Lighting changes are costly with old-fashioned fixed outlet systems! Lick this problem once and for all with modern, economical BullDog Universal Trol-E-Duct.

Every inch of this sensational 50-Amp. duct system provides for a tap off! To move or add lights or small power tools, simply pick the right spot and insert handy twist-out plug or trolley. And it can be dismantled and moved *anywhere, anytime* without scrapping a single part.

Learn more about this modern, efficient system today from your nearby Amalgamated Field Engineer. Or write Amalgamated direct for descriptive literature.

To top off power at any point along the slot, simply insert twist-out plug and give it a 90° turn. Plugs are grounded on a steel casing before contacts touch bus bars; narrow-access slot protects operator.



Duct sections are joined without tools, nuts or screws. Pre-fabricated and standardized in five and ten foot lengths, they can be dismantled and reinstalled anytime, anywhere without scrapping a single part.

A·E CORP'N LTD

AMALGAMATED
ELECTRIC CORPORATION LTD.

The Leader in Flexible Distribution Systems

MONTREAL • TORONTO • WINNIPEG • CALGARY • VANCOUVER

Ellis and J. D. Cummings. No. 1942 — Magnetic modulators, by E. P. Feich and others. No. 1943 — Elementary L_1-spaces, by L. A. MacColl. No. 1944 — Electron-hole production in Ge by alpha-particles by K.G. McKay. No. 1945 — Stabilization of dielectrics, by H. A. Sauer and others. No. 1946 — Radiated and diffracted sound fields, by F. M. Wiener. No. 1947 — Tubes for millimeter waves, by J. R. Pierce. No. 1948 — Inhomogeneous electrical properties of diamond, by A. J. Ahearn. No. 1949 — Formation and drift velocities of noble gas ions, by J. A. Hornbeck and J. P. Molnar. No. 1950 — Frequency detection and speech formants by E. Peterson.

British electrical and allied industries research association. Technical reports:

No. G/XT132 — Gas-blast circuit breakers: the technique of recording current in A.C. power arcs around the period of current zero, with some applications, by F. O. Mason. No. G/T249 — Oil circuit-breakers pressure set up by sudden increase of fault current in an arc control pot, by W. B. Whitney and others. No. J/T154 — The effect of cold drawing on the creep resistance and structure of 0.5% molybdenum steel steam piping by E. A. Jenkinson and D. C. Herbert. No. L/T266 — On the vibrations of long-chain molecules — I, by B. Szigeti. No. LT267 — The torsional vibrations of long chain molecules — II, by B. Szigeti. No. Q/T119 — The equivalent circuit of the capacitor transformer, by M. Waters. No. Q/T121 — The calculation of currents due to faults between turns in transformer windings, by B. L. Coleman.

Canada. National research council. Associate committee on soil and snow mechanics. Technical memoranda:

No. 23 — Proceedings of the Fifth Canadian soil mechanics conference, January 10 and 11, 1952.

Canada. National research council. Canadian government specifications board. Specifications:

No. 3-GP-0 — Methods of testing petroleum and associated products. No. 22-GP-32 — Brush; deck scrub, hand. No. 25-GP-12 — Compound; sweeping, oil base.

Canada. National research council. Division of mechanical engineering Quarterly bulletin:
1 April to 30 June 1952.

Swedish state shipbuilding experimental tank. Publications:
No. 20 — Model tests with icebreakers, by H. F. Nordstrom and others.

Toronto. University. Faculty of applied science and engineering. Wallberg lectures:
5th — The engineer and government, by C. D. Howe.

PAMPHLETS RECEIVED

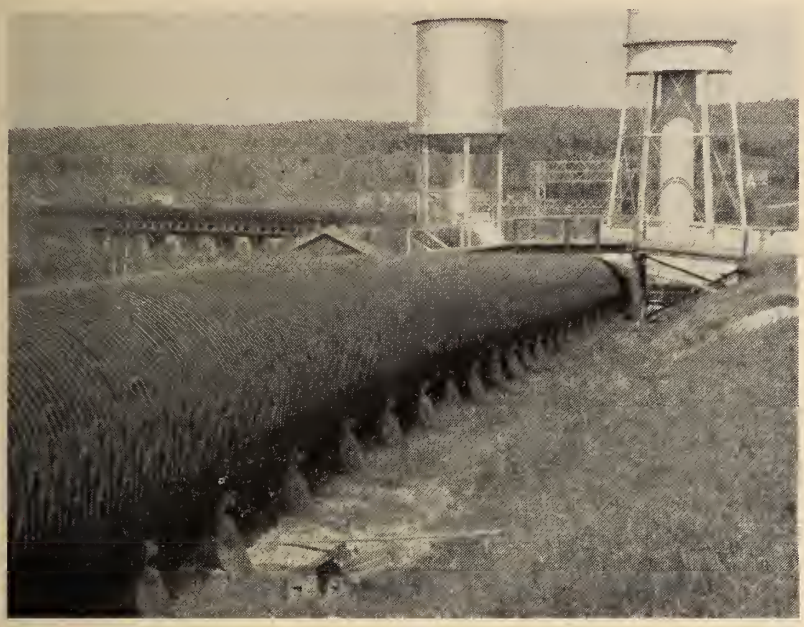
Canadian jews in world war II. Part II. casualties. Canadian Jewish congress. Montreal, the congress, 1948.

Industry in action in La province de Québec. Canadian geographical society. Ottawa, the society.

P.B. poles. London, British insulated callender's cables limited, 1952.

Zoning and traffic. E. G. Mogren and W. S. Smith. Saugatuck, Conn., Eno foundation for highway traffic control, 1952.

Wood Stave Pipe for Power Development



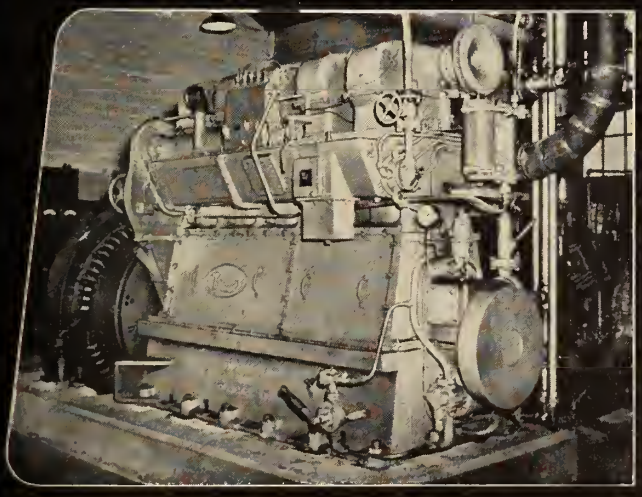
Our B.C. Fir continuous Wood Stave Pipe has been constructed by us in all parts of Canada and other countries since 1904. It is made permanent with our Pacific Metal Butt Joint (Patented) for connecting stave ends and by Pressure Creosote treatment applied to Staves and Cradles.

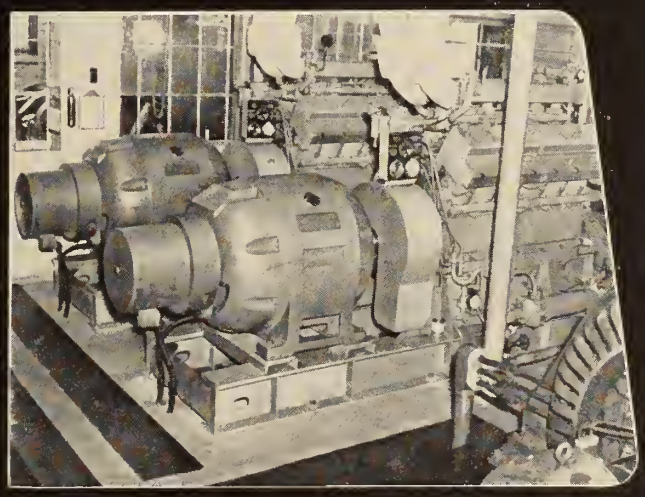
Pacific Coast Pipe Co. Ltd.

1551 GRANVILLE ST. ESTABLISHED 1904 VANCOUVER, CANADA

RUSTON-PAXMAN *diesel power*

Paxman diesels at a Sydney, Nova Scotia Dockyard and a Yarmouth cotton mill





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Job Brothers & Co. Ltd., St. John's, Newfoundland Electrical Industries Ltd., Edmonton, Alberta. Vancouver Machinery Depot, Ltd., Vancouver, B.C.

BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

Appointments and Transfers

Truck Engineering Changes.—A. N. Giasson has been named sales manager of the trailers, utility bodies, winches and auxiliary truck equipment departments of Truck Engineering Limited, Woodstock, Ont.

James A Spence has been named assistant secretary and assistant treasurer by the company. Mr. Spence will assume the duties of P. E. Hulbig, secretary, and H. S. King, treasurer, both of whom are on extended leave of absence for reasons of health.

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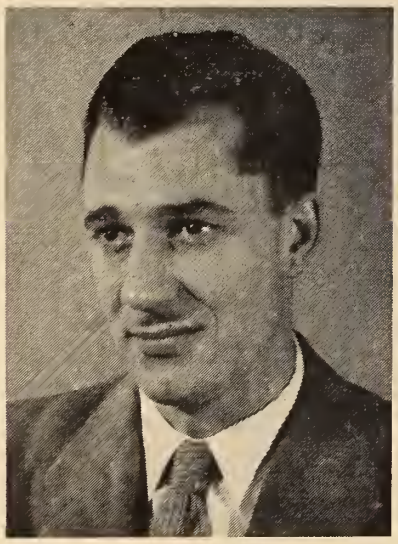


A. N. Giasson

E. G. Lomas.—E. G. Lomas has been appointed to form an engineering sales division within Photographic Survey Corporation Applied Research Limited Toronto.

•

J. N. Stanley.—J. N. Stanley, vice-president of Reliance Electric & Engineering (Canada) Limited, has moved his headquarters from Welland to the Company's Toronto district office located at 1 Willingdon Boulevard, Toronto. Mr. Stanley was the sales vice-president of Commonwealth Electric Corporation Limited when it became Reliance Electric & Engineering (Canada) Limited in 1951. In his new capacity he will co-operate with Reliance sales representatives in the field as a special consultant. His services will be available with respect to the selection, manufacture, sale and installation of distribution and power transformers among industries and public utility commissions throughout Canada.

•

P. D. MacIntyre

P. D. MacIntyre.—P. D. MacIntyre has been appointed manager of industrial relations for Canadian Allis-Chalmers (1951) Ltd. Mr. MacIntyre who is a graduate of St. Francis Xavier University joined the Company in September 1940. He was appointed personnel manager in 1941.

•

Brown Boveri Office.—Brown, Boveri (Canada) Limited has opened its first Ontario office which is located in Toronto at 249 Victoria Street.

The new Ontario headquarters will be under the management of Fraser Fargey.

•

Atlas Steel Purchasing.—William Murray Lawrason has been named manager of purchasing by Atlas Steels Limited. Mr. Lawrason will be assisted by C. K. Edward, purchasing agent and C. H. Randall, assistant purchasing agent.

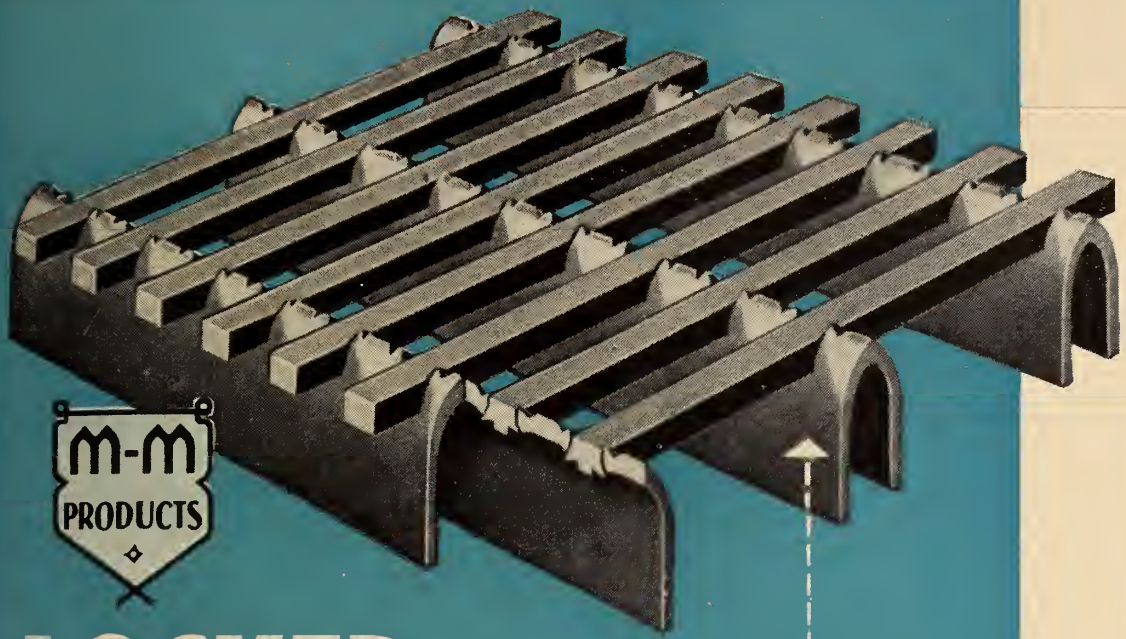
•

D. T. Jones

Trane Appointments.—Trane Company of Canada Ltd., has announced the appointment of D. T. Jones as sales engineer in the Calgary office.

Edwin C. Phillips has been named assistant to the general manager. Before joining the Trane organization, Mr. Phillips held a similar executive position with Consumers' Gas Company of Toronto.

•



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LOCKED...

WITH A GRIP OF

80 TONS

By a unique manufacturing process, mat bars and ∩-shaped carriers of M-M SAFETY GRATINGS are locked together by dies under 80 tons pressure.

The result is a rigid, permanent unit with excellent load carrying properties.

M-M non-skid gratings shed water and oil, provide unusual transmission of light and wear indefinitely. They are extensively used in commercial and industrial buildings and in public institutions throughout Canada.

Sectional view of M-M Safety Grating shows how carriers and mat bars are permanently locked together.

Write for catalogue No. TF -100 giving complete details.

DOMINION BRIDGE COMPANY LIMITED

M-M Products are manufactured at the Toronto plant of Dominion Bridge Co. Ltd., 1139 Shaw Street.

Plants at: MONTREAL, OTTAWA, TORONTO, WINNIPEG, CALGARY, VANCOUVER

When Specifications in STEEL PLATE are EXACTING

Fractionating Towers

Canadian industry turns to Toronto Iron Works for jobs that require unusual ability and experience in the fabrication of steel plate. T.I.W. fabricated and erected these fractionating towers for one of Canada's great oil companies.

1H

THE T.I.W. STEEL PLATE PRODUCTS

TORONTO IRON WORKS LIMITED

DESIGNERS, FABRICATORS, ERECTORS • TORONTO • CANADA

E. C. Phillips

B. F. Goodrich Expansion.—The establishment of an industrial products district sales office for the province of Ontario with headquarters in Toronto, was announced, recently, by H. P. Hawkins, general manager of the industrial products sales division of the B. F. Goodrich Rubber Company of Canada, Ltd.

Fraser Muter has been appointed district manager of the new sales office.

Howard Janke takes over Mr. Muter's former responsibilities as special representative to Ontario electrical appliance manufacturers and Douglas Baker, formerly estimator and correspondent for Vulcalock sales will replace Mr. Janke as industrial products representative in the Hamilton and Niagara peninsula areas.

•

K. M. Chirgwin.—K. M. Chirgwin, senior motor design engineer of the English Electric Company of Canada, is addressing the members of the A.I.E.E. at the middle eastern district meeting to be held in Toledo, Ohio.

Mr. Chirgwin's paper will be entitled "Apparatus for Determination of Induction Motor Torque".

•

K. M. Chirgwin

DRAVO *Counterflo* HEATERS

have a certified High Standard of Safety!

ALL STANDARD MODELS, BOTH GAS-FIRED AND OIL-FIRED, LISTED BY UNDERWRITERS' LABORATORIES, INC.

ALL GAS-FIRED STANDARD MODELS APPROVED BY AMERICAN GAS ASSOCIATION.

plus— ACCEPTANCE BY FACTORY MUTUAL ENGINEERING DIVISION OF DRAVO STANDARDIZED SAFETY CONTROL CIRCUIT.

DRAVO HEATER SAFETY MEANS SAVINGS FOR YOU

Because they have this safety approval, you'll find you can obtain the lowest-possible insurance rates with Dravo *Counterflo* Heaters. These savings represent only part of the many savings you get with Dravo warm-air Heaters. For instance:

DRAVO HEATERS OFFER YOU . . .

- low initial cost . . . savings up to 60% on installation
- concentration of heat at working levels
- 150-foot air throw . . . no duct work required
- flexibility . . . units can be mounted in any position on floor, wall or ceiling
- automatic operation . . . on-off or modulating controls
- long service life . . . low maintenance . . . stainless steel combustion chamber eliminates refractory lining
- mobility . . . can be moved easily to any location
- low fuel consumption . . . direct-fired . . . burns gas or oil . . . readily converted

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These versatile heaters are ideal for commercial and industrial use in foundries . . . warehouses . . . machine shops . . . stores . . . schools . . . churches . . . process industries . . . and many others. Why not look into the possibilities of Dravo Heaters for your heating and ventilating needs? Write today for Bulletin No. 523.

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HEATING DIVISION
MARINE INDUSTRIES LIMITED
SOREL, QUEBEC

W. G. Bell.—William G. Bell has been named associate director of the Electronics Division of the Department of Defence Production. He succeeds Alexander G. Lester, of Montreal, who has returned to his former duties with the Bell Telephone Company.

●

Russel-Hipwell Appointments.—Russel-Hipwell Engines Limited have annouced the following appointments.

Norman H. Robertson has been elected a director of the Company.

Albert J. Maddox is now in the sales organization and will co-ordinate all government contracts.

●

C. P. Brown.—Carl P. Brown has been named manager of industrial and export sales by the Kobe Inc. Division of Dresser Equipment Co.

●

De Salaberry Explosives Plant.—The Right Honourable C. D. Howe, Minister of Defence Production has announced that Canadian Arsenals Ltd. will resume management of the de Salaberry Explosives plant at Valleyfield, Que.

●

C.I.T.F. Representatives.—The Right Honourable C. D. Howe, Minister of Trade and Commerce has announced the re-appointment of special representatives for the Canadian International Trade Fair.

These special representatives, covering Canada from coast to coast, will continue the work initiated with outstanding success last year in acquainting Canadian businessmen with the purposes and function of the Trade Fair.

The appointments are:

F. R. Wilgress, of Vancouver, who will work throughout British Columbia and Alberta.

Campbell Millar, of Winnipeg, who will continue the work he organized last year in Manitoba and Saskatchewan.

D. R. Platt, London, Ont., who will again act as special representative in Western Ontario.

R. C. Brown, Guelph, who will represent the Fair in West-Central Ontario and the Niagara Peninsula.

Paul H. Dubar, who will cover the Toronto area.

H. E. Taylor, who will be associated with Mr. Dubar in the Toronto district.

John W. Reddish, will also cover part of Toronto.

R. H. Cardine, will cover Eastern Ontario and John Neville will represent the Fair in the Province of Quebec.

M. J. Edwards will concentrate his work for the Fair in Montreal.

J. G. Farquhar of Halifax will represent the Fair in the Maritime provinces.

●

Bepco Affiliates.—A visit to Bepco Canada Limited has been made by a party of representatives from each of the four British constituent companies. The members of the party were J. W. Rodger, managing director and A. K. Aitkenhead, assistant secretary, Bruce Peebles & Co. Ltd. D. E. Graham, general sales manager, overseas division, Crompton Parkinson Ltd.; R. W. Weekes, managing director, Harland Engineering Co. Ltd., and D. C. Lorkin, joint managing director, Lancashire Dynamo & Crypto Ltd.

●

Goodyear Tire Appointment.—W. G. "Goldie" Britt, has been appointed manager—molded goods sales of the Goodyear Tire & Rubber Company of Canada Ltd.

Mr. Britt will be responsible for the expanding market for molded rubber goods, which has resulted from the rapid industrial growth in Canada. He took over his duties in Quebec City on October 1st.

●

Dominion, Scott, Barron Ltd.—Announcement was made in Toronto, recently, of the formation of "Dominion, Scott, Barron Limited". The new organization has been formed to provide fabrication and assembly arangements in Canada of the products of United Kingdom manufacturers.

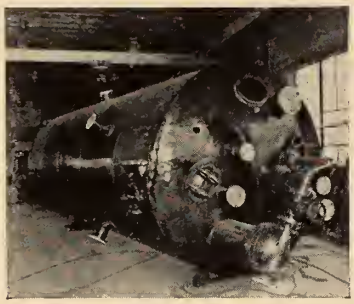
Principals are Henry Balfour & Co. Ltd. of Leven, Fife, Scotland; George Scott & Sons (London) Ltd.; Ernest Scott & Co. Ltd., London, England; W. S. Barron & Sons Ltd., of Gloucester, England; and Dominion Wheel & Foundries Ltd., Toronto, an associate of Canada Iron Foundries Ltd., Montreal.

These manufactories may be within the scope of pulp and paper, mining, metallurgical, gas, chemical, food processing or other business. Dominion, Scott, Barron Ltd. will set up the plant for services ranging from preliminary laboratory research to final poduction, whether product or by-product, natural or synthetic.

The new Canadian company will have a directorate drawn from executives of both the British and Canadian principals. They will fabricate here with resident technical advice and engineering from the British group. Dominion, Scott, Barron Ltd., will build process plants for all of Canada and the United States.

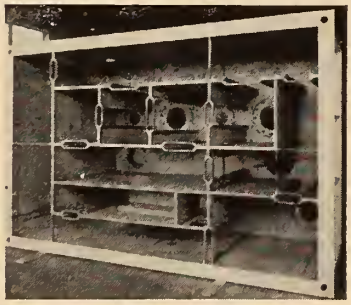
●

in the "custom-fabricated" business since 1875



Platework

STEEL PRESSURE VESSELS,
CUSTOM-FABRICATED TANKS,
WELDMENTS



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New Equipemnt and Developments

Alloy Metal Warehouse.—Alloy Metal Sales Limited opened a new warehouse on Fleet Street, Toronto, on September 25th. The new storage facilities have been provided to meet the rising demand for modern metals—Monel, nickel, stainless, steels, Inconel and aluminum.

The opening ceremonies covered two days Sept. 25 and 26. On the 25th more than 100 suppliers and their representatives, for the most part from the United States, were tendered a luncheon and dinner and on Friday, approximately 600 customers were toured through the offices and warehouses of the plant. Later, they were tendered a reception and buffet on the premises.

Featured speaker at the Thursday luncheon was Dr. O. J. Firestone, economic adviser, Department of Trade and Commerce, Ottawa.

•

Trans-Canada Highway.—The extension of the Trans-Canada Highway method of joint financing by the federal and provincial governments to include other highways of national importance is held to be essential if adequate highway system is to be had in Canada, according to P. G. Wilmut, president of the Canadian Construction Association. This statement was made at an address to members of the Kitchener-Waterloo Builders' Exchange on October 2nd.

•

Scrap Metal.—Steel mill, foundry and scrap dealers representatives from many parts of Canada met here recently for a conference on iron and steel scrap supplies and specifications.

First, meetings of the Canadian Scrap Iron and Steel Committee discussed means of maintaining an adequate flow of scrap for Canada's fast-growing steel and iron industry and, secondly, joint dealer and consumer discussions were held to provide a modernized code of specifications for scrap grades, with a view to its general adoption.

•

Capacitor Motor.—A new capacitor motor is now being manufactured by Canadian General Electric Company in 2- and 3-HP ratings. This capacitor-start, induction-run, single-phase motor is compact and 15 to 20 per cent lighter than the old single-phase motor designs.

The motor is specially designed for driving air and refrigeration compressors, pumps, fans, conveyors and all general-purpose applications. Ample starting torque is provided for hard-to-start jobs.

Designated as type KCS, the new capacitor motor is available at 1800 r.p.m., 60 cycles. It is dual voltage 110/220 volts. For further information, contact your nearest C.G.E. office.

•

Employee Discrimination.—Discrimination by contractors employed by the Federal Government is prohibited by an order in council it was announced on September 25th by the Hon. Milton F. Gregg, Minister of Labour.

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Contractors are forbidden to discriminate in the employment of labour for reasons of race, natural origin, colour or religion. The anti-discrimination clause is to be included in all contracts made by the Government of Canada for construction, remodelling, repair or demolition of public buildings or other works or for the manufacturing and supply of equipment, materials and supplies.

The order in council becomes effective January 1st, 1953.

•

Circuit-breaker.—Amalgamated Electric Corp. Ltd. is introducing into Canada a new type of Pushmatic circuit-breaker, developed by Bull Dog Electric Products Company, Detroit.

The "Pushmatic" is a small, compact, single-pole device for controlling and protecting electrical circuits. It is claimed that it is a direct answer to the problem of resetting after overloads or short circuits; it is "the modern approach to smart compact design and interchangeability in electrical load centres." Pushmatic protection and control will, it is claimed, eliminate the need to buy or replace fuses. These circuit-breakers, both thermal and thermal-magnetic types, and Electri-Center devices are being manufactured by Amalgamated Electric Corporation Limited. They are being made available from stock through electrical wholesalers across Canada.

•

Testing Pressure Instruments. — A periodic check of pressure instruments with a reliable test gauge has been known, in many instances, to save process fluid or otherwise reduce operating costs in amounts many times the cost of the test device. The Foxboro Company, who are represented in Canada by Peacock Brothers Limited, Ville La-Salle, Montreal, Que., offers an appropriate test instrument in the form of the 6" Model P Test Gauge. This 6" gauge is furnished in ranges of 0-30 Hg. vac. up to 0-10,000 p.s.i.g., and guaranteed accurate within ½ of 1 per cent of the total scale at any point throughout its range. Suitable tapered pipe male thread connections are provided. The measuring element is a full 270° Bourdon spring of steel or beryllium copper. The movement consists of a chrome-plated steel pinion, segment and arbor, monel plates and a stainless steel hairspring.

•

Forest Protection.—Following representations made by the province and the lands and mines minister of the Federal government — the Federal government agreed to participate with the government of New Brunswick in attacking a serious threat to hundreds of millions of dollars worth of valuable balsam fir and spruce forests in Northern New Brunswick. More than 4,000 square miles in northern New Brunswick are now seriously affected by the budworm. In the absence of preventive measure, timber with a stumpage value of some one hundred million dollars is threatened with destruction. Earlier this year, an experimental spraying operation from the air was carried out on 200,000 acres in the infested areas as a joint undertaking by the New Brunswick Government and private industry. The operation is considered to have been successful. The large-scale operation now being planned provided for the spraying of some two and half million acres of forest. The work will be completed by 1954. An immediate start is being made on the construction of airstrips in the infested area.

•

Unique Steam Hammer.—A new, steam-operated hammer that "literally floats on a concrete raft in a concrete basin" has just forged its 15,000th ingot at the Huntingdon Works of the International Nickel Company, making a total production for the hammer of 75,000,000 pounds.

Details of the design and construction of the mounting are so new that they have been previously withheld until the development had proved its value in service.

Much of the production to date has been forgings of the high nickel alloys used for jet engine parts and other heat-resistant applications. The strength and toughness of these materials are such that they pose special forging problems not common in the production of the more widely used industrial metals.

With an over-all weight of 521 tons, this modern prototype of the old-time village smithy — about three stories — converts huge nickel alloy ingots from the melt shop into workable forms for further processing as sheet, strip, rod, wire, tubing and other commercial forms.

An elaborate arrangement of springs eliminates ground vibration which re-

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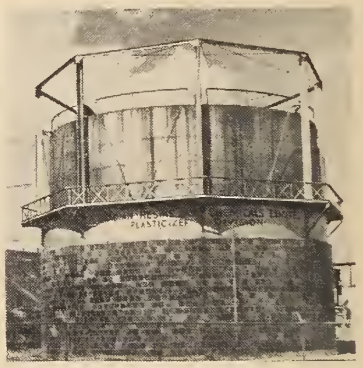
•



Left: 40,000 cu. ft. Horton gasholder 50 ft. in diam. and 50 ft. high.

•

The Horton welded gasholder shown above was installed at the plasticizer plant of the Canadian Resins and Chemicals Limited at Shawinigan Falls, Que. It is used for the storage of hydrogen gas which is consumed in large quantities in the synthesis of 2-ethyl-hexanol (an alcohol).

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duces maintenance costs throughout the plant as well as in the forge shop.

Legs and anvil of the hammer are bolted to a concrete base 21 feet long, 18 feet wide, and 10 feet thick. This base rides on a unique type of rubber spring, or cushion, supported by a second block of concrete of similar size. Both concrete blocks form the "raft". The rubber spring is a slab of special-type rubber, bonded on each side to a steel plate.

The bottom of the second, or lower, concrete block in turn rides on 432 steel coil springs, somewhat resembling those on a railroad car.

The steel springs are mounted on a concrete floor supported by cement piles, or pillars. Altogether, the foundation from the top of the uppermost concrete block to the bottom of the pillars reaches 40 feet below the floor of the forge shop.

This construction differs radically from the conventional steam hammer foundation which hitherto has consisted of concrete pad and several tiers of lumber 12 inches square.

Vibration from the old-type foundation could be felt throughout the 90 acre plant. Its effect was marked on other equipment in the hammer shop as well as in all other adjacent buildings.

The foundation represents a joint development by J. H. A. Crockett, London, England, the designer; Robert W. Hunt Company, New York City, who had technical supervision of the construction; the engineering staff of the Huntington Works; and various technical consultants.

●

Government Controls.—On September 17th, the Minister of Defence Production announced that effective immediately, control orders NFM-3-copper wire and rod, NFM-4-wrought copper and copper alloys, and aluminum order NFM-2, have been amended, making it no longer necessary for industry to submit their orders for Canadian mill products to the Department for approval. Primary metals and imports from the United States are not affected by these amendments.

●

Permafrost Studies.—Field study of some of the problems resulting from permafrost as affecting building operations has been studied by the Division of Building Research of the National Research Council. A small experimental permafrost research station is now being established at Norman Wells, N.W.T., with the co-operation of Imperial Oil Ltd., who operate a small oil field and refinery at this far northern outpost on the Mackenzie River. It will be some time before the first results from this work will be available as is inevitable with all research which is so completely dependent upon climate.

●

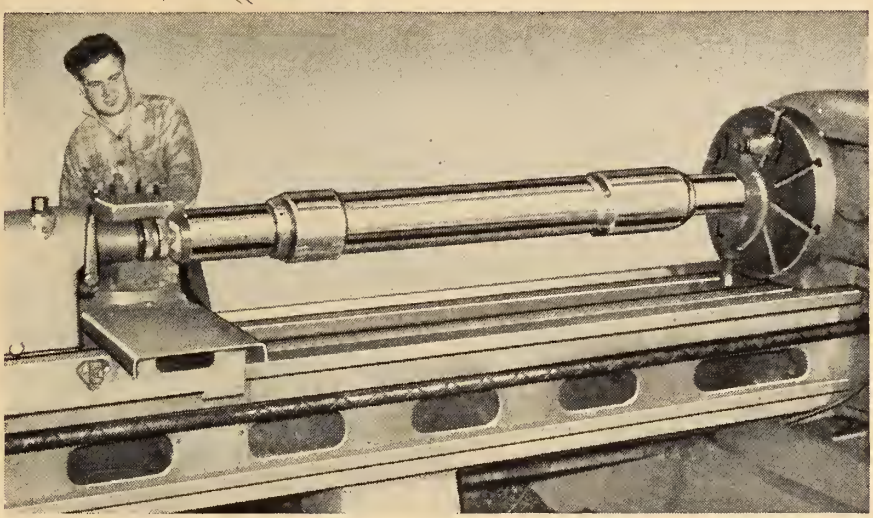
New Transformer.—A new transformer development on the Canadian market is the Westinghouse protected dry-type transformer with built-in Nofuz breakers in the primary winding.

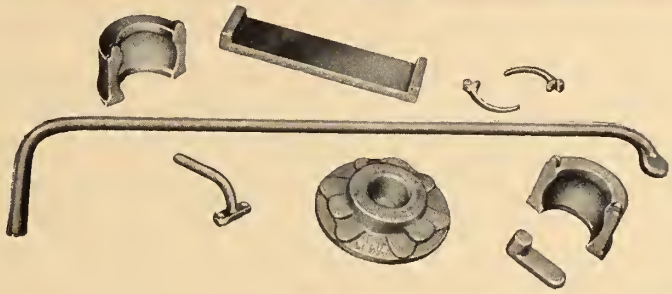
First major installation is in the Company's own new Beach Road plant, Hamilton.

Operation of the built-in circuit breaker, in the new dry-type transformer, is by thermal magnetic action. Better overload protection results because in the chimney-type transformer construction the ventilating air stream rising through the coils passes over the breaker. Since the breaker operates in the ambient inside the transformer it is

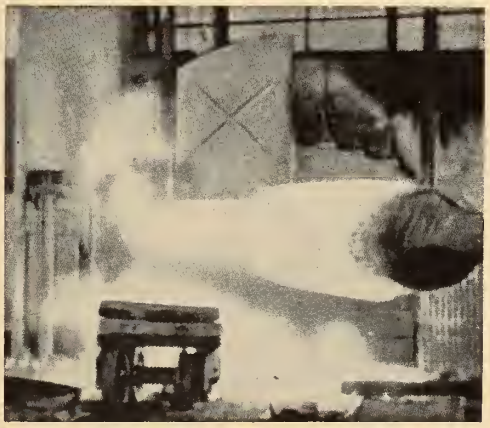
Canforge

FORGINGS FOR THE POWERFUL NEW DIESELS





Wherever and whenever a new need arises for light or heavy forgings, the great Canforge plant at Welland is first choice of Canadian industry. From the heavy steel forged axles on which these monsters roll, to handrails and journal boxes, diesel locomotive manufacturers turn to Canada Foundries & Forgings Limited and its up-to-date forging equipment and complete facilities for machining!



Withdrawing a white hot ingot

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more efficient than if externally mounted.

Under normal conditions the breaker is not affected by moderate or momentary overloads. However, when such overloads last for dangerous time values, the circuit is opened through the action of the bi-metallic thermal element. Short circuit currents cause the magnetic element to trip the breaker instantly. Heavier overloads of less than short-circuit value are removed from the line by the co-operative action of the thermal and magnetic elements. With these transformers, the high voltage lines can be brought close to the works, eliminating long runs of heavy copper. Improved voltage regulation eliminates light flicker and motor "groaning" on starting loads. There is also a saving in lower installation and operating costs and transformer capacity is increased because system losses are less.

•

G.-M. Diesel Plant Expanded.—Further expansion of the plant of General Motors Diesel Limited, London, Ontario, at a cost of $2,500,000 is announced by acting general manager, John W. Brophy. It will be the second extension since the plant was officially opened in August, 1950.

The addition will make an important step in providing for the railroads complete service facilities to handle wrecked locomotives, and to rebuild and repair major components such as traction motors, generators and engines.

Another major phase of the additional building and equipment will permit the manufacture in London of a new model traction motor, as well as the fabrication of truck frames and a number of other components for several locomotive models. The latest addition will be a continuation easterly of the plant proper, and to the rear of the engineering and development centre which was built a year ago.

•

New 2 & 3 Wire Meter.—For installations where a future change-over from 2-wire to 3-wire service is expected, Canadian Westinghouse has developed a double shunt coil 2-wire, 3-wire meter. The coils are in parallel when connected for 2-wire service and in series for 3-wire service so that the voltage characteristics of the meter are unchanged on half voltage. When connected for 2-wire service, only one half of the 3-wire current winding is connected into the cicuit. A jumper is used to complete the circuit through the meter the same as in a standard 2-wire meter.

The meters are shipped connected for 2-wire service and 2 nameplates are mounted, one on top of the other. The same meter serial number is stamped on each nameplate, so that in converting to a 3-wire meter it is only necessary to remove the top nameplate. To obtain a meter with high accuracies when applied to 115 or 230 volt service, a divided potential coil design was developed. Because of full potential flux on either connection, equal torques are developed. This provides the same wide calibrating range on either service. The full load speed of the meter is 12½ r.p.m. when connected for 2-wire service, and 25 r.p.m. on the 3-wire connection. This permits the change to be made without changing the register. Recalibration in some cases is unnecessary.

For complete details communicate with Canadian Westinghouse Company Limited, Hamilton, Ont.

•

Large U.S. Transformer Order.—The English Electric Company has announced receipt of an order valued at 200,000 dollars by the United States Bureau of Reclamation, which is responsible to the United States Government, for an 80,000 kva.-transformer installation for the Folsom Power Station in California. It is to have a voltage ratio auto-connected of 230,000/115,000. In common with other United Kingdom manufacturers, the English Electric Company has continued to tender for United States transformer business since the loss of the orders for the city of Seattle some two years ago. The company is well placed to undertake the manufacture of this big transformer for in its Stafford, England, works the first 120,000-kva. 275,000/132,000-volts auto-connected transformer is now being built for the British Electricity Authority.

•

Invention May Save Life On The Roads.—A new safety device which may help considerably to cut down road fatalities is now being tried out in Eng-

(*Continued on page 1167*)

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1162*)

land. It is a wire mesh scoop, fitted to the front and the inside surface of the four wheels of heavy vehicles such as lorries and buses. Whichever way the vehicle turns, the device turns with the wheels. It can be operated by the driver, or automatically, and can be fitted to all four wheels.

This device was tested in an "accident" staged in London before representatives of various transport organisations. A man threw himself in the path of a coach fitted with the scoop. The "victim" was hit by the rear-side wheels and then pushed aside. He got up, dusted himself and walked over to the group of spectators, absolutely unhurt.

The inventor of this safety measure, Mr. William Atkins, of Hockley, Essex, England, has also developed non-skid chains that can be fitted to motor cycles and bicycles.

•

Battery Developments. — Among developments of interest to electrical engineers which were being shown at the recent British Industries Fair were a battery reviver which will extend the useful life of a dry battery—as used in radio receivers, hearing aids and so on—by three to six times. The unit is very simple to use and the batteries are connected to it periodically for about the same number of hours as they have been in use. The device is a product of Amplion Ltd., 230, Tottenham Court Road, London, W. 1.

Another interesting product was an 'all-climate' battery which can be stocked indefinitely in every type of climatic condition. It is factory-sealed with special microporous separators and needs only to be filled with acid to be ready for immediate use.

These "all-climate" batteries are specially packed for export in a unit which consists of a tailor-made moulding of resin-bonded sawdust, two inches thick. Makers are Buckland Battery Company, 189/195, High Street, London, S.W. 17.

•

The "Staffa" King-Pin Remover.—A heavy-duty hydraulic tool has been designed by Messrs. Chamberlain Industries, Ltd., of Staffa Works, Leyton, London, E. 10, for removing and replacing the king pins used in the steering gear of motor road vehicles. It is known as the Staffa king-pin remover and will fit the axles of most road-transport vehicles. The tool consists of a manually-operated hydraulic pump, connected by a 7 foot length of flexible hose to a single-acting spring-return hydraulic ram. Under a hydraulic pressure of 5,500 lb. per square inch, the ram exerts a force of 26,880 lb.

The cylinder of the hydraulic ram is screwed into a press frame comprising rigid cross members, of 2 inch steel plate, and hexagonal tie rods having long threaded upper ends to allow a wide range of adjustment of the depth of the frame. The tie rods pass through the lower cross member and are secured by nuts. The centre of the lower yoke is drilled with a 2 inch hole to permit the passage of the king-pin as it is forced out of its bush by the action of the hydraulic ram. Pusher pins, with an effective length of 6½ inches, are available in diameters of ¾, ⅞ and 1 inch.

The tool can also be used for re-fitting king-pins. For this purpose a spigoted plate is inserted in the hole of the lower plate and the pin rests on the plate for lining up. During re-fitting the ram remains stationary on top of the axle and the application of hydraulic pressure causes the cylinder to move backwards drawing the press frame upwards and driving the king-pins smoothly into the bush.

•

A Mechanical Knotter.—A mechanical knotter has been introduced by Ingfield Products of Oldham, in the English county of Lancashire. This neat, precision-made instrument will tie two distinct types of knots, namely, a round knot, similar to a weaver's knot, and a round non-slip textile knot. The textile knot is positioned round the yarn in such a manner that two intersecting coils are formed which, when tensioned, lock each other to prevent slipping.

The instrument, which can be quickly converted from tying one knot to the other, is light in weight and can be supplied in various types to tie different yarns. It is available with hand, belt and rail fitting attachments.

•

(*Continued on page 1170*)

EST. 1893

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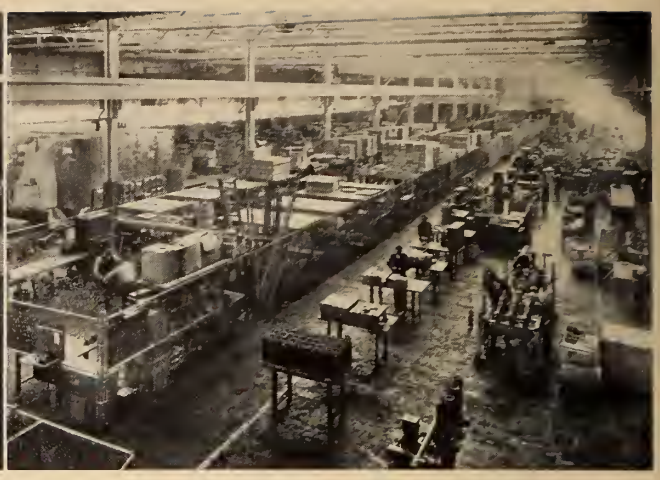

The transformer core and coil, and the current breaker assembly shops at the Brown Boveri (Canada) plant, St. Johns, Que.

Brown, Boveri Open Canadian Plant.

Brown, Boveri & Co. Ltd., manufacturers of electric and thermal power equipment, was founded in 1891 in Baden, Switzerland. The Company has been exporting to Canada since the beginning of the century. In 1933, a wholly-owned subsidiary, Brown Boveri (Canada) Ltd. was formed in Montreal.

In view of Canada's growing industrial expansion and the increasing acceptance of Brown Boveri products throughout Canada, it was decided, in 1950, to build a factory at St. Johns, Que. The initial products of the Canadian plant are switchboards, airblast circuit breakers, power and distribution transformers. Construction was commenced last year and the plant was completed in April of this year.

Plant Description

The new Canadian plant is located on 44 acres and provides for future expansion. The building itself contains from 55,000 sq. ft. given over to manufacturing operations and 7,200 sq. ft. occupied by the office area. The building is of fireproof construction throughout and completely sprinkler equipped.

The power house contains two fully automatic oil-fired boilers of 120-hp each. The plant also has a 40-hp compressor for general air-power use in the factory, and a special compressor for testing airblast circuit breakers.

The outdoor electric sub-station was designed by Brown Boveri Company and houses a 450-KVA Brown Boveri transformer. Electrical power is supplied by the Southern Canada Power Company and stepped down from 48,000 volts to 6,000 volts. To assist in the operation of the factory and in the training of the necessary skilled labour, some 35 technicians and their families were brought to Canada from the parent concern in Switzerland.

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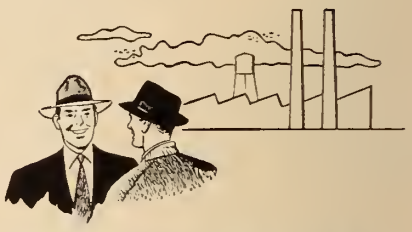

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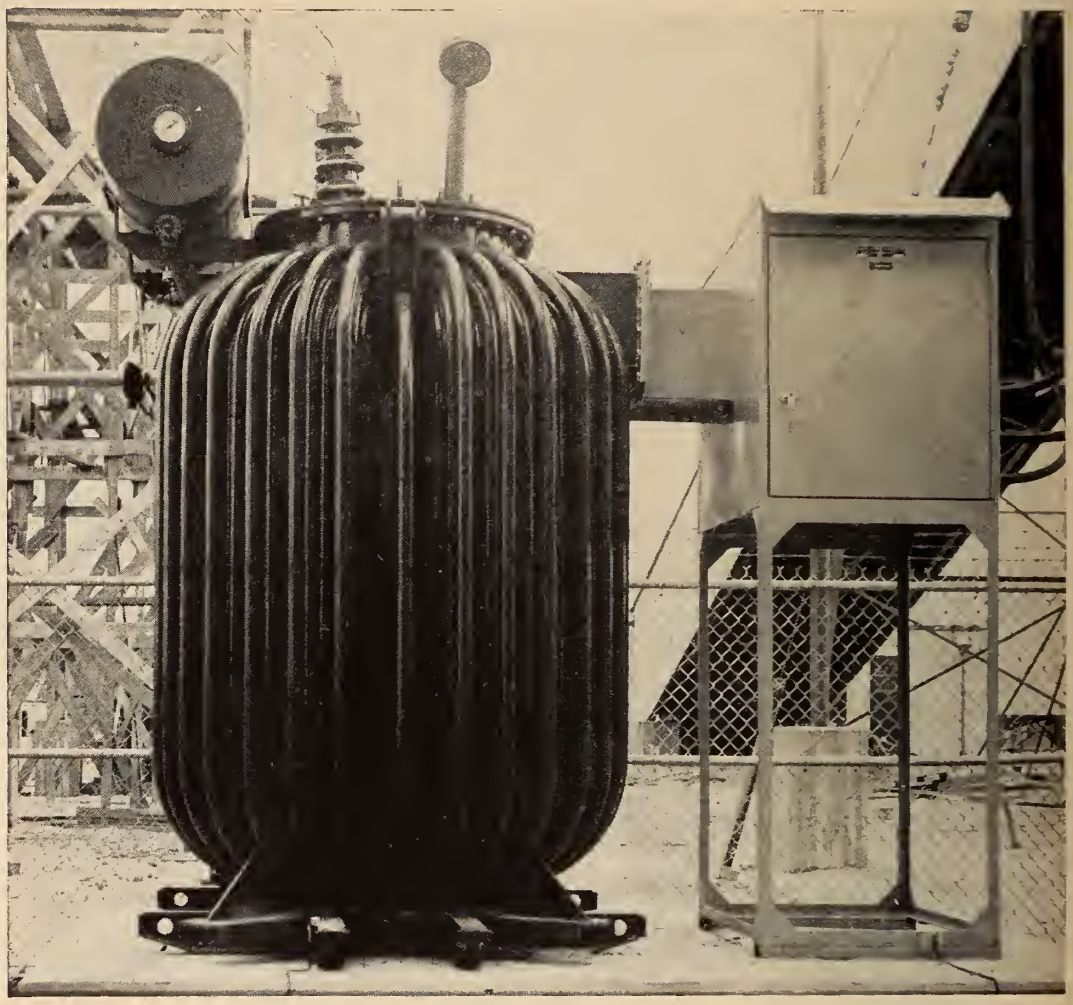

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Construction Methods on Ontario Hydro's New Niagara Power Development

by

G. Mitchell, M.E.I.C.

Project Manager,
Sir Adam Beck-Niagara Generating Station No. 2
Ontario Hydro-Electric Power Commission,
Niagara Falls.

A paper presented before the Toronto Branch of The Engineering Institute of Canada on April 17, 1952.

This paper deals with the power project now being built at Niagara Falls, known as "Sir Adam Beck-Niagara No. 2 Development", and "Sir Adam Beck-Niagara No. 1 Development", the first unit of which went into operation in January, 1922.

The first step leading up to the Sir Adam Beck No. 2 Development was the Treaty signed in 1950, dealing with the allocation of water from the Niagara River. As you probably know, the Treaty signed in 1910 between the United States and Canada allocated a definite amount of water to be used for power purposes to each country—20,000 c.f.s. for the United States and 36,000 for Canada. The difference was due to a U.S.-owned power plant located on the Canadian side, which was exporting power to the United States. Then, during the late war, the amounts were raised by mutual agreement to 32,500 c.f.s. for the United States and 49,000 for Canada, the difference being for the same reason as before.

By the Treaty signed in 1950, each country was allocated half the excess flowing down the river over a fixed quantity. This quantity is 100,000 c.f.s. for summer months, except at night when it is 50,000, and 50,000 c.f.s. for winter months. Thus, if the flow down the river is 200,000 c.f.s., which is about average, there would be allotted to each country 50,000 c.f.s. for the summer months except at night when it would be 75,000 and 75,000 for the winter months. This is a much better arrangement than formerly, because it not only allots more water for power purposes, but it allows the use of water for power when flows are above normal, and because more water is available for power in the winter months, a period when it is most needed.

As soon as the Treaty was signed the Commission arranged for an immediate start on the construction of this $300,000,000 development known as Sir Adam Beck-Niagara Generating Station No. 2, which will have a rated capacity of 1,200,000 hp. in 12 units of 100,000 hp. each.

Tunnel vs. Canal

The No. 1 Development includes an intake structure at Chippawa, a deepening of the Welland River with a reversal of flow for 4½ miles, and the construction of a canal 8½ miles long from Montrose on the Welland River to a forebay and gatehouse located on the edge of the Niagara River Gorge. The powerhouse is located immediately below on the shore of the river. It contains, besides two service units, 10 main units varying in capacity from 52,500 to 58,000 hp. each, with a rated capacity of 560,000 hp. for the entire development.

For the No. 2 Development there will be two intakes near Chippawa, two tunnels each about 29,000 ft. long, a canal 12,000 ft. long terminating in the forebay, a headworks and the powerhouse. As for why tunnels are being used this time instead of a canal, the reason is that the canal for No. 1 Plant is 48 ft. wide between concrete linings, with a capacity of 16,000 c.f.s., while for the 40,000 c.f.s. of water required this time for the ultimate development, it would take a canal about 200 ft. wide in rock. When depth of overburden is considered, it would mean an overall width of about 450 ft. in some places. It can be visualized what it would mean to dig such a wide canal through this highly developed section of the country, with earth and rock cuts as deep as 140 feet. It was considered to be out of the question and was not seriously entertained.

A wide canal was not such an important matter for the first development, because the canal at that time was largely farm land. But now the district is thickly populated, and tunnel construction was considered to give the least disruption to city and township life. Actually, since the job started, except for a few homes in the immediate vicinity of two of the shafts, the people of Niagara Falls and Stamford Township hardly know this huge undertaking is underway. You will note I have said nothing about the economics of tunnel versus canal. Actually, estimates indicate that the tunnel will cost little more than a canal.

Here, the author takes you on a personally conducted tour over one of Canada's largest current hydro-electric construction projects, leaving the design features and statistics to be dealt with in future articles.

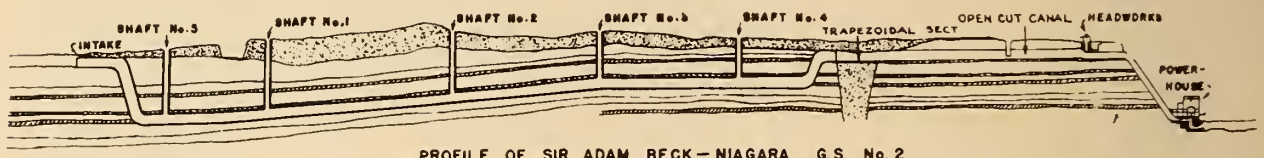
Fig. 1. Right—Existing headworks and powerhouse, Sir Adam Beck-Niagara No. 1. Slots in rock are penstock trenches. Long Bailey bridge is for erection of lower penstock elbows. Short Bailey bridge is a moving concreting bridge for powerhouse substructure to top of draft tubes.

Model Used for Intake

Starting at the upstream end of the project, one of the first problems was to determine where and how should water be drawn from the river for the new development. No. 1 Development, and all the powerhouses on the American side, draw water from what is known as Grassy Pool. This is the area of water extending from a rock weir, built in 1943 to control the pool level up to Navy Island. It was fairly obvious that the intake had to be somewhere between Chippawa and the rock weir.

However, a model was built of the river, reproducing that part of it from just below the Falls to a point well above Chippawa. The purpose of the model is not only to determine the location of the new intake but also the type, and to investigate the works necessary to preserve the level of Grassy Pool, because of the additional quantity of water which will be drawn from it. The model will also indicate what remedial works are necessary to preserve the scenic beauty of the Falls.

It has been found that the best place for the intakes is about a quarter of a mile below Chippawa, and that one that performs satisfactorily is a Johnston-Wahlman type. This intake is a submerged gathering tube, which will be about 500 ft. long, and which will parallel the shore of the river, its largest section being about 45 ft. by 45 ft. Tests show that it admits water satisfactorily and that it allows ice to pass



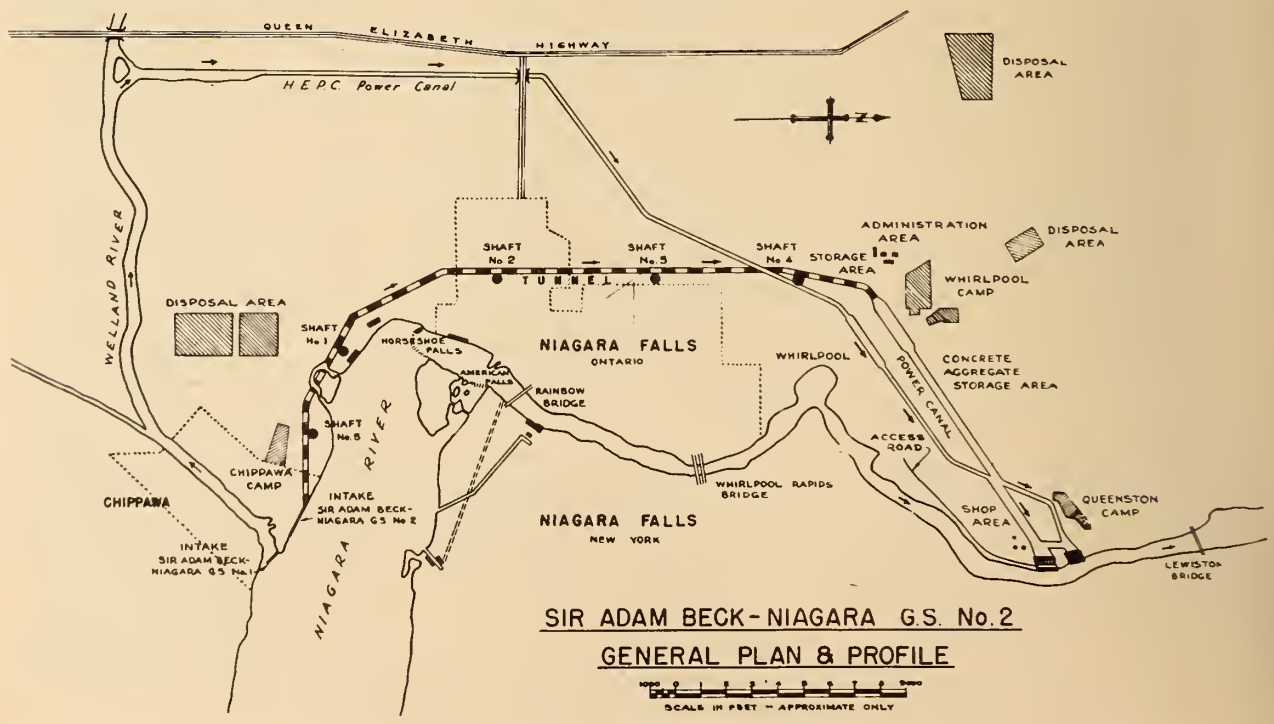


Fig. 2. General plan and profile.

safely down the river without being drawn into the tube. Ice has been the bugbear of all power-plant operation on the Niagara River. When conditions are right in Lake Erie, huge flows come down the river and have caused considerable trouble in past years. There should be no trouble using the Wahlman gathering tube type of intake.

Tunnels

After passing the intakes, the water, which will be controlled by gate structures, will flow down into the tunnels that pass under the City of Niagara Falls, under the present canal and will emerge just north of the Canadian National tracks at the whirlpool. The tunnels will be circular and will have an excavated diameter of 51 ft. When lined with concrete they will have a finished diameter of 45 ft. Each will be, as stated before, about 29,000 ft. long. When completed, these will be the longest tunnels of this size ever built.

It is interesting to note that the deepest part of the tunnels is at the upstream end. This is because the dip of the rock rises in a northerly direction about 28 ft. to the mile. Rock in the Niagara District is predominantly limestones, dolomites and shales, and the depth of the tunnels was influenced by the location of a good layer of limestone which will form the roof. So at the south end the distance from ground to invert level is about 330 ft., and at the north end about 200 ft. For constructing the tunnels, five shafts have been sunk, each about 30 ft. in diameter. These are sunk in between the tunnels, so that only one set of shafts is necessary for the construction of both.

Contracts have been let for the construction of the tunnels. Perini-Walsh and Associates, who are largely U.S. contractors, are building sections 3, 4 and 5. Rayner-Atlas, Canadian contractors, are building sections 1 and 2. Because of different depths of overburden, shafts 3, 4 and 5 were sunk to rock by means of steel sheet piling, braced with circular structural steel rings. Shafts 1 and 2 were sunk using a reinforced concrete casing. Depth to rock at Shaft No. 1 was 106 ft.

New and Old Canals Cross

Where the flow emerges from the tunnels there will be gate structures, followed by an open canal. The first part of this canal is a trapezoidal section where it crosses an ancient river gorge, really an extension of the gorge at the whirlpool. Finally, flow continues through a rectangular section of solid rock about 200 ft. wide. In this form it crosses the existing canal, with the water levels of the two canals at the same level, and enters the new forebay which is just upstream from the existing forebay. An interconnecting canal between the old and new forebays will permit a free exchange of water.

A problem, which has been solved by model tests, arose where the water emerges from the tunnels, passes through a control structure, and flows into the trapezoidal section. Here we have in a comparatively short distance a water passage which changes from round in the tunnel to rectangular in the control section, then to trapezoidal in the canal. Each tunnel will come up from 200 ft. below ground level by two vertical and one horizontal

Fig. 3. View inside tunnel. Left is ventilating pipe. Ribs are 8 in. x 8 in. H-section, spaced on 4 ft. centres; lagging is 6 in. channel. Excavation is by heading and bench.

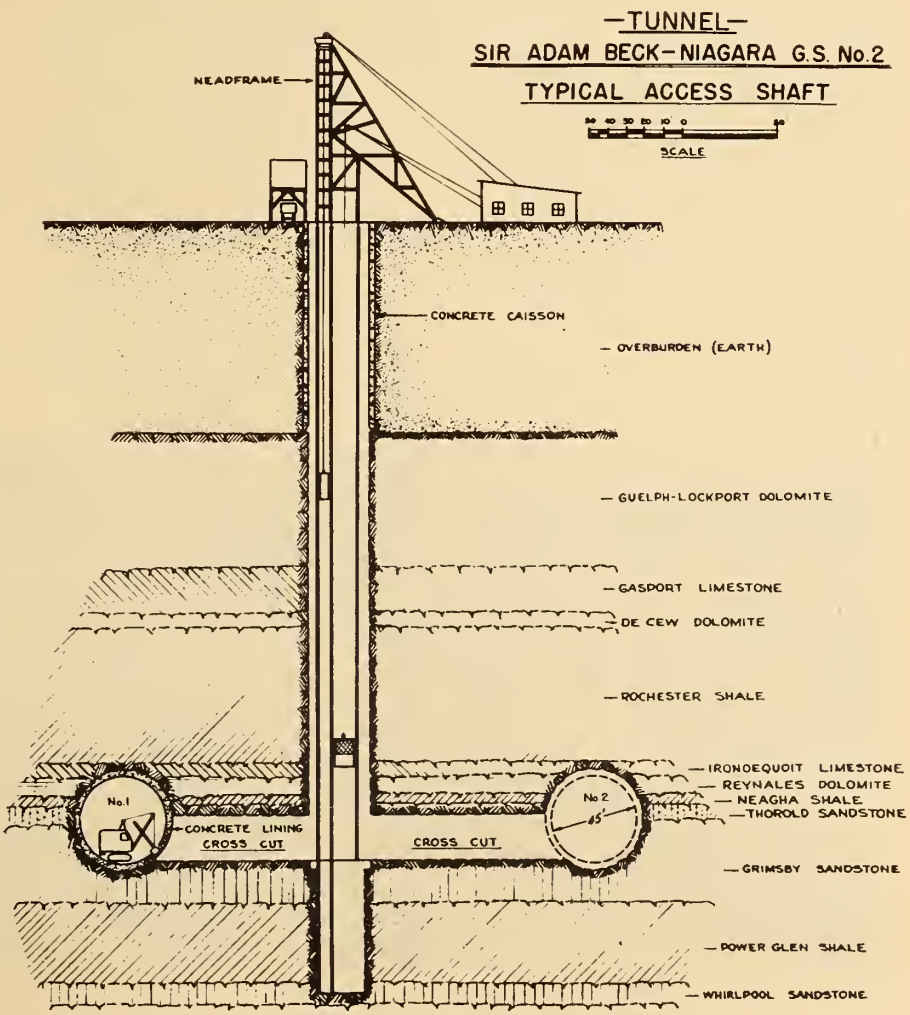


Fig. 4. Tunnel. Typical access shaft.

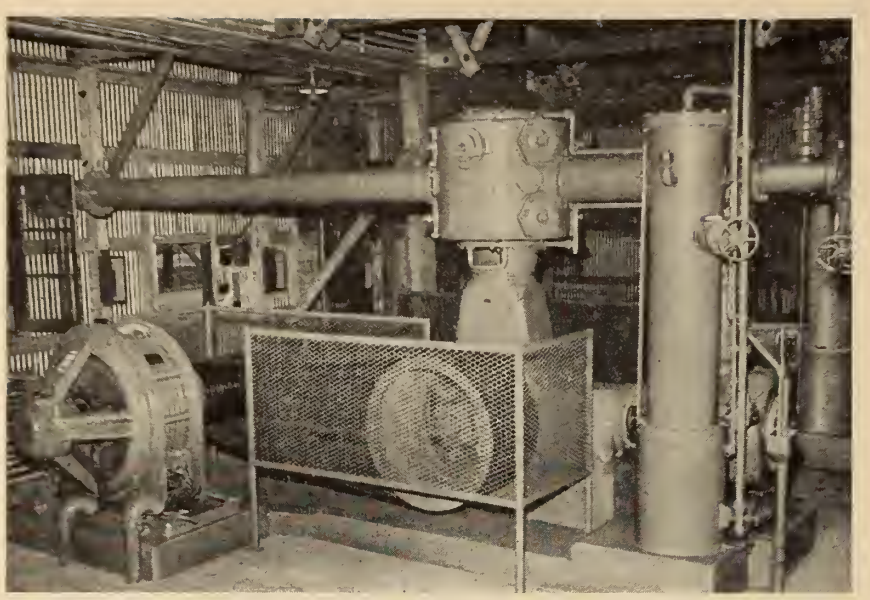


Fig. 5. Two compressors with a total capacity of 2,000 c.f.m. furnishing air for rock drilling and other operations in the intake area.

bend. It has been quite a problem to get the best profile of tunnel at this location.

One of the most interesting problems to solve has arisen where the two canals cross. The unknown here was whether two high velocity canals, the old one with a velocity of up to 15 ft. per second, the new one up to 7 ft. per second, could cross satisfactorily at common invert grade and water levels. To the best of our knowledge, this never had been done before. Model studies have shown that by offsetting the outgoing centre line of the new canal 45 ft., it is possible to cross without undue turbulence and consequent loss of head. Water coming from the old canal flows down the new channel and a portion of water from the new flows down the old.

Model Saves Money on Forebay

A model was also built of the forebay. It was thought that the design as already placed on paper was going to work satisfactorily, but the model proved otherwise. It was found that there were two substantial dead spots of water in the forebay, and by eliminating these two dead spots a saving of some 250,000 cu. yds. of rock excavation was effected.

The headworks at the forebay will not be built with the large superstructure which stands on the headworks of No. 1 Development. It will be a very modest structure which will contain the hoisting machinery for operating the gates. A gantry will be used for the lifting of racks.

In the present powerhouse the transformers and a large part of the switch gear are inside. In the new plant, however, transformers will be outside between the powerhouse superstructure and the slope of the bank, and the switching structure will be on top of the escarpment on an island between the two forebays. So the powerhouse superstructure of the new plant will be on a somewhat smaller scale than for the No. 1 plant.

Housing Construction Personnel

When the job was first started one of the first decisions had to do with the housing of men. The Commission had been told by City of Niagara Falls and Stamford Township authorities that there was absolutely no accommodation, and that all housing was taken up. It was found that this was largely true, so it was decided to build camps. The question immediately arose as to where to build to best service the job. The total length of the job is about 8½ miles. Since there was no room in the city and in the densely populated parts of Stamford Township for camps, the obvious thing to do was to locate a camp close to the intake, another as close to the half-way mark as possible, and a third at the powerhouse end.

At any rate, this coincided pretty well with the density of the work, the intake camp looking after all intake work and three shafts for the tunnel, and the whirlpool camp looking after the other two shafts, the trapezoidal section, and part of the canal. The powerhouse camp looks after the rest of the canal, the forebay and the powerhouse. We also had to decide on how many men to provide for in camps. As a guess our engineers provided for about 35 per cent of the total estimated

Fig. 6. Model of existing and new forebays with interconnecting canal. Existing forebay at rear. Model saved 250,000 cu. yds. of excavation.

Fig. 7. Model of intersection of existing and new canals. Dye shows path of water. Centre line of new canal above and below the intersection is offset.

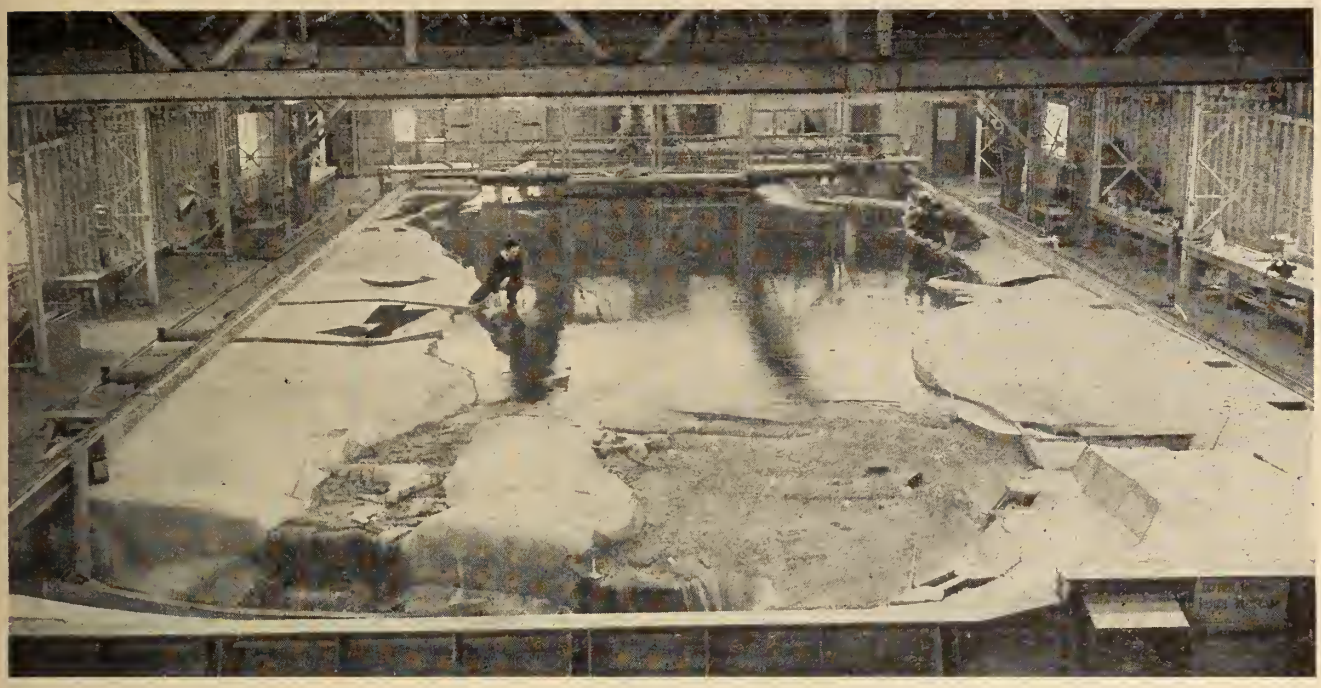


Fig. 8. Model of the Niagara River from the Canadian and American Falls to beyond Navy Island. Intake to Sir Adam Beck-Niagara No. 1 is immediately to the left of the three men kneeling on the right of the picture. The structures in the lower right corner are (top) intake to the Ontario powerhouse—(middle) Toronto powerhouse—(bottom) Canadian Niagara powerhouse (just below Falls).

strength required to construct the Development. It looks as though this guess was about right. Supervisory staff who wish to move their families to the district have been provided with housing by the Commission on a rental basis.

Sites for Shops and Mixers

Then there was the question of shops, where to put them to service the large quantities of equipment needed to excavate and dispose of something like 8.5 million cubic yards of earth and rock in the canal and forebay. The location was influenced by a decision of the Commission to let the tunnel by contract, so the bulk of the work which Commission forces are doing extended from the trapezoidal section through to the powerhouse. The decision was therefore made to locate the shops at the powerhouse end, this being more or less in the centre of excavating operations. Here it is close enough to the powerhouse to be of service there when installation of machinery is being done. A small shop is provided for the intake work.

The next question was, what would be done about concrete aggregates and concrete plants? All coarse aggregate for concrete is coming from crushed rock, which will be obtained from the canal excavation. The obvious place to put the crusher plant was therefore near the canal. A decision had also to be made as to how many concrete plants should be built, and their location. There is concrete to place at so many different points. Obviously, the thing to do was to establish central mixing plants and truck the concrete. It was decided to establish two, one for the upper end of the job and one for the lower. The upper one at Chippawa will supply concrete for the three sections of the tunnels at the upper end and the intake, and the lower one will serve the two lower sections of the tunnels, the trapezoidal section and the headworks and powerhouse. Coarse aggregates will therefore be trucked or shipped by car to the Chippawa plant from the crusher plant. Sand comes by train from deposits near Paris and Brantford, although some is being obtained from deposits at the mouth of the river near Niagara-on-the-Lake.

Disposal

For the disposal of excavated material, two main dumps have been established, though a great quantity of earth and rock has already been disposed of along lands owned by the Commission close to the new canal. The disposal dump on Mountain Road is the dump used on the first job. It will still hold all the material which is going to be excavated on the lower end of the work. The dump for the upper end is established close to shaft No. 1 and will be on land which is largely waste at the present time.

The matter of construction roads presented quite a problem. It was decided to keep off city and township roads as much as possible, because they are not built for the heavy trucks in use on the project, of 15-, 22- and 30-ton pay load capacity. Thus it has been arranged that to great extent roads built by the Commission on Commission property will be used. Where they cross existing highways and streets, traffic lights have been installed. Altogether the length of construction roads built will be about 25 miles.

For this job the Commission has established a 30-bed hospital. The project has its own fire brigade, its own security police, its own sewerage disposal plants and has developed its own recreation facilities. Water is being purchased from the Township, but all the mains for servicing the various parts of the project have been laid by the Commission.

Equipment

Some of you no doubt will be interested in some of the equipment used on the job. For excavating the canal and forebay of 4.0 million cu. yds. of earth and 4.5 million cu. yds. of rock, there are: about 90 large dump trucks of 15-, 22- and 30-ton capacities; one 6-cu. yd. electric dragline machine; one 4-cu. yd. electric shovel; three 3½-cu. yd. diesel driven shovels; five 2½-cu. yd. diesel driven shovels; 38 heavy bulldozers; two rotary type drills, drilling 6¼-inch holes only and good for the softer type rock which

(Continued on page 1184)

Prefabricated Steel Vessels for Inland Waters

by

T. A. McLaren, M.E.I.C.

Managing Director,
Allied Builders Limited, Vancouver.

A paper presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada at Vancouver, May 5, 1952.

This paper shows how welding has made possible substantial savings in shipment and on-site assembly costs for prefabricated steel vessels. Barges for deck cargoes and oil, railroad car ferries, even self-propelled vessels upwards of 100 feet in length, are thus built in complete units without the need for shipyard assembly. They are erected on remote inland waters with simple light equipment, and with as little as 25 per cent of the labour cost spent in the field.

The problem of building steel vessels for inaccessible points on inland waters is not new. It has been undertaken for many years, and several British firms have made a specialty of this type of work, building vessels for re-erection on African, South American and Oriental rivers and lakes.

This paper will deal particularly with vessels built for western and northern Canada. In these areas wooden vessels have been used almost exclusively until the past few years. However, the advantages of steel construction over wooden construction are very marked, principally in fresh water, where wood seems to rot quickly and corrosion to steel is practically nil. There has been a definite trend in the past few years towards replacing wooden vessels with steel. Owners enlarging their fleets specify new steel vessels almost exclusively.

Riveted Construction

Before welding came into general use, riveted steel vessels were shipped to inland waters. The general procedure was to erect the vessel completely in the shipbuilder's yard, fairing up all holes, and then unbolting the whole vessel into small pieces for shipment. The assembly at distant point could be undertaken with very little plant and equipment. In most cases the vessel was riveted by hand, and in many cases was erected by squads of native workmen who had never before seen a steel vessel. Where labour costs are relatively low, this method is quite satisfactory. However, in this part of the world with exceedingly high labour costs such a procedure, involving a duplication of erection, would tend to price the steel vessel out of competition with other forms of construction.

Welded Construction

With the introduction of welding into ship construction, and the great strides made in prefabrication of large assemblies during the war, it became evident that vessels for re-erection could be fabricated in large sections. They could then be shipped to their final destination in heavy bulky units, rather than in individual plates and angles.

In many cases, the procedure for

The author, T. A. McLaren, M.E.I.C. (left) and R. A. McLachlan, M.E.I.C. chairman of the session.

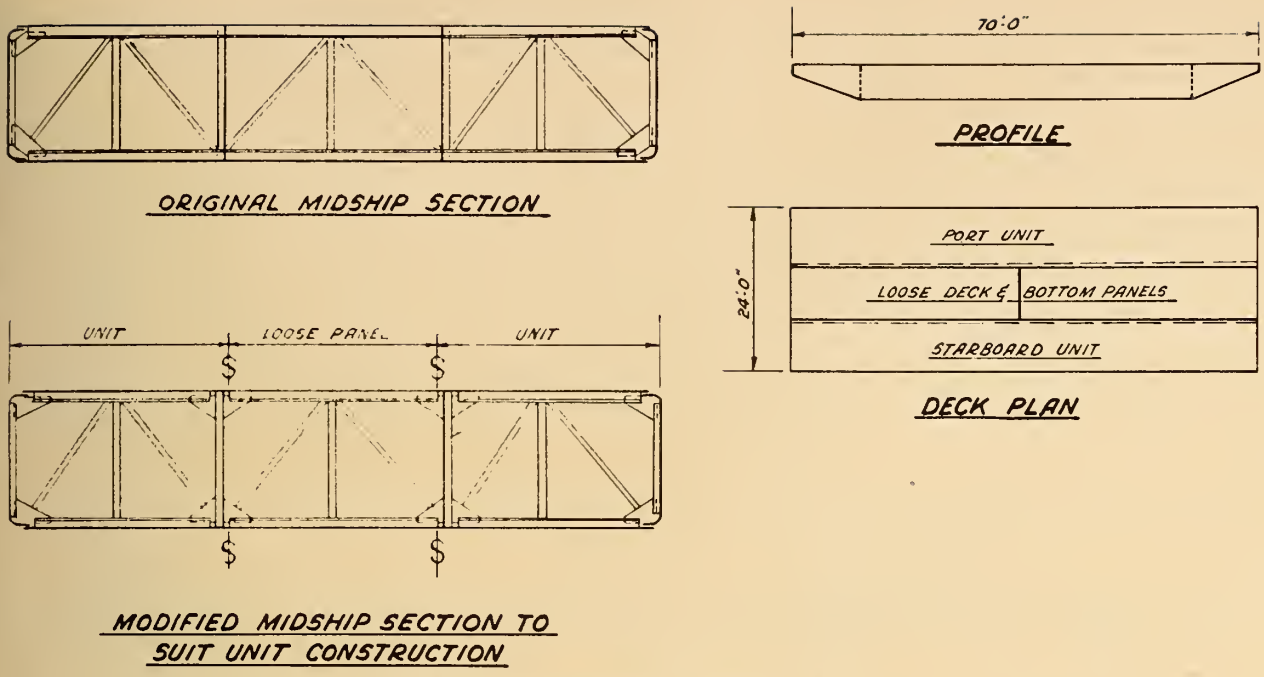


Fig. 1. Ferry barge, 70 ft. x 24 ft. x 5 ft.

building such a vessel for shipment has been to completely erect and weld the hull in the builder's yard, then proceed with cutting torch and cut the vessel into sections of the largest size that can be carried in a railway car. The disadvantage of such a scheme, of course, is that the vessel is completely erected and welded and brought up to the stage where it is ready for launching. It is then cut up into sections, shipped, and finally re-erected and welded. There is still considerable duplication of labour in such a procedure.

This paper deals with methods whereby vessels can be built in complete units and forwarded for final erection, these units being so designed that it is unnecessary to erect the vessel at the shipyard. Instead, the units are forwarded to the final erection site and assembled there. By such a procedure there is no duplication of labour.

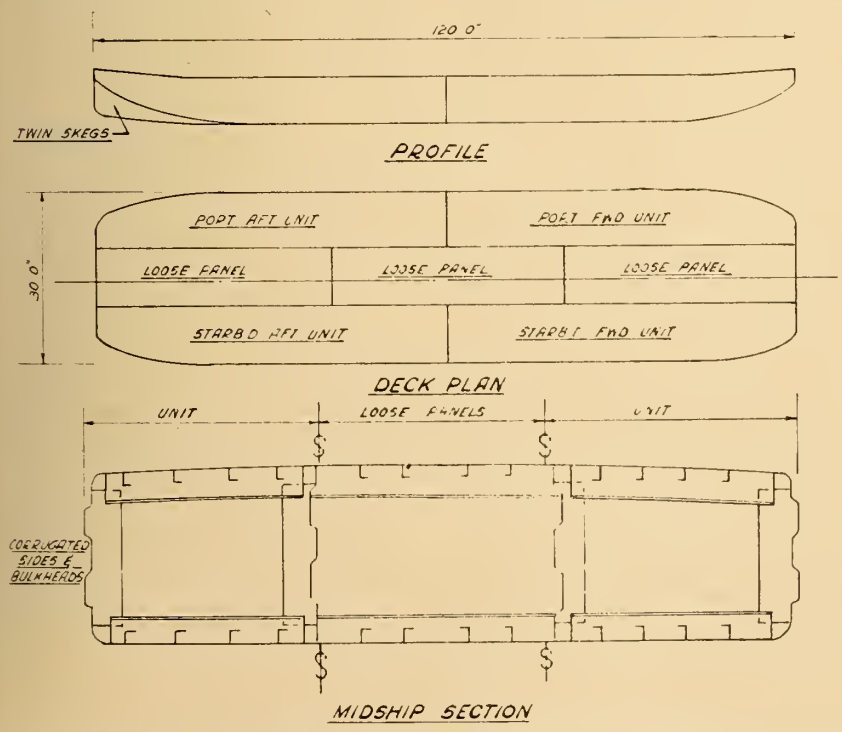


Fig. 2. Tank and deck barge for Mackenzie River service 120 ft. x 30 ft. x 7 ft. 6 in.

Steel Barges

The greatest number of vessels built for inland waters in recent years have been barges. Barges are used in this part of the continent for carrying deck cargoes, oil, railway cars, and also in many cases to act as ferries. In most cases these ferries are outfitted with a large gasoline or diesel winch on the deck, which warps the vessel across the river on steel cables.

Most of these vessels are of simple scow shape, though in many cases the lines have been altered slightly to suit ice-breaking and beaching conditions. Some of the earlier barges built were prefabricated in the shipyard in the form of flat panels with the framing attached thereto. These panels were shipped out on flat cars, or trucked, to the site of erection. Here the panels were assembled into the final hull.

This procedure meant a considerable amount of labour being employed in the field, and also, in nearly all cases, a mobile crane was necessary. The cost of maintaining a crew and equipment in the field is rather high. It is necessary to induce men onto the job with overtime pay, and the transportation cost on cranes and other equipment becomes quite a factor in the total erection costs. The matter has therefore been investigated, and the principle of erecting the vessels in

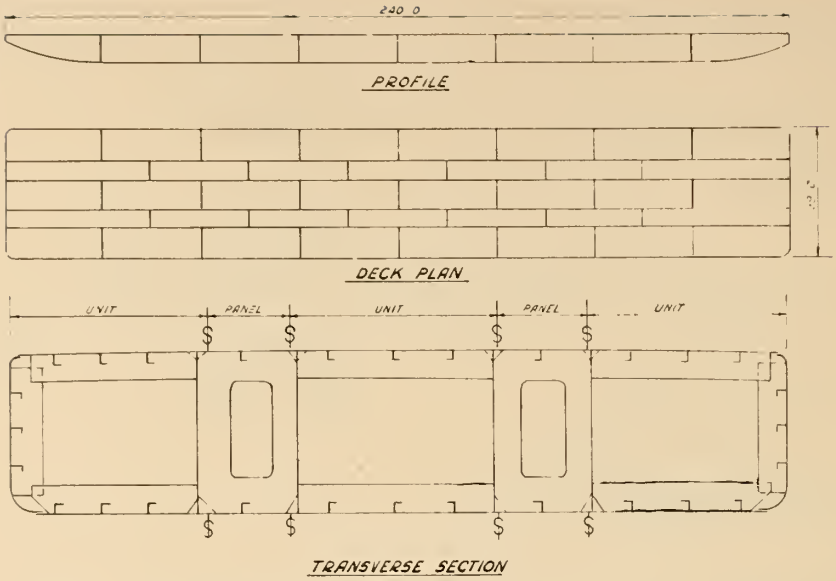


Fig. 3. Railway barge for C.P.R. lake service, 240 ft. x 38 ft. x 8 ft.

units has been adopted as the most practical method of undertaking this type of work.

Fig. 1 shows the midship section and general proportions of a 70 ft. long steel ferry barge, three of which have been built for the interior of British Columbia. The first two were constructed in accordance with the drawings supplied by the Department of Public Works, the construction of which is shown on the original midship section. It will be noted that the vessel consists of two longitudinal bulkheads and transverse framing. In making the original vessels this plan was adhered to closely, and the barges were prefabricated in the form of panels and erected on the site. In the case of the third barge, however, permission was requested to alter the midship section so that both the deck beams and the floors were severed near the longitudinal bulkheads and attached thereto by brackets. By altering the structure of the barge in this manner it was possible to make it in two units with connecting panels.

Erection Cost Cut 60 Per Cent

The barge was prefabricated in the form of a port unit and a starboard unit, each 70 ft. long, approximately 8 ft. wide and 5 ft. deep. The connecting steelwork between these two units was shipped in the form of flat panels. These 70-ft. units were transported on two flat cars. Upon arrival at the erection site they were skidded off the railway cars to adjacent launching ways, the centre unit faired into place, and the barge welded together. This barge, which had approximately 50 tons of steel in it, was erected by six men in 12 working days. It is interesting to compare this figure with the two earlier barges, which occupied seven men for 26 working days. The economics of the unit construction can readily be appraised.

Fig. 2 shows a combination tank and deck barge used largely on the Mackenzie River and its tributaries. It might be added that some forty of these vessels have been built since the war, and generally constructed along these lines. It will be seen that this barge is longitudinally framed and, again, has two longitudinal bulkheads. As in Fig. 1, the vessel was shipped in pontoon sections, with the centre panels shipped loose. These barges are 120 ft. long, 30 ft. wide and 7ft. 6 in. deep. The side pontoon units, however, are cut in half, into 60-ft. sections, this being about the limit that the railways can handle. Each of these 60-ft. units weighs approximately 18 tons. In re-erecting these barges at the site, a crew of 15 men can complete a barge in five working days.

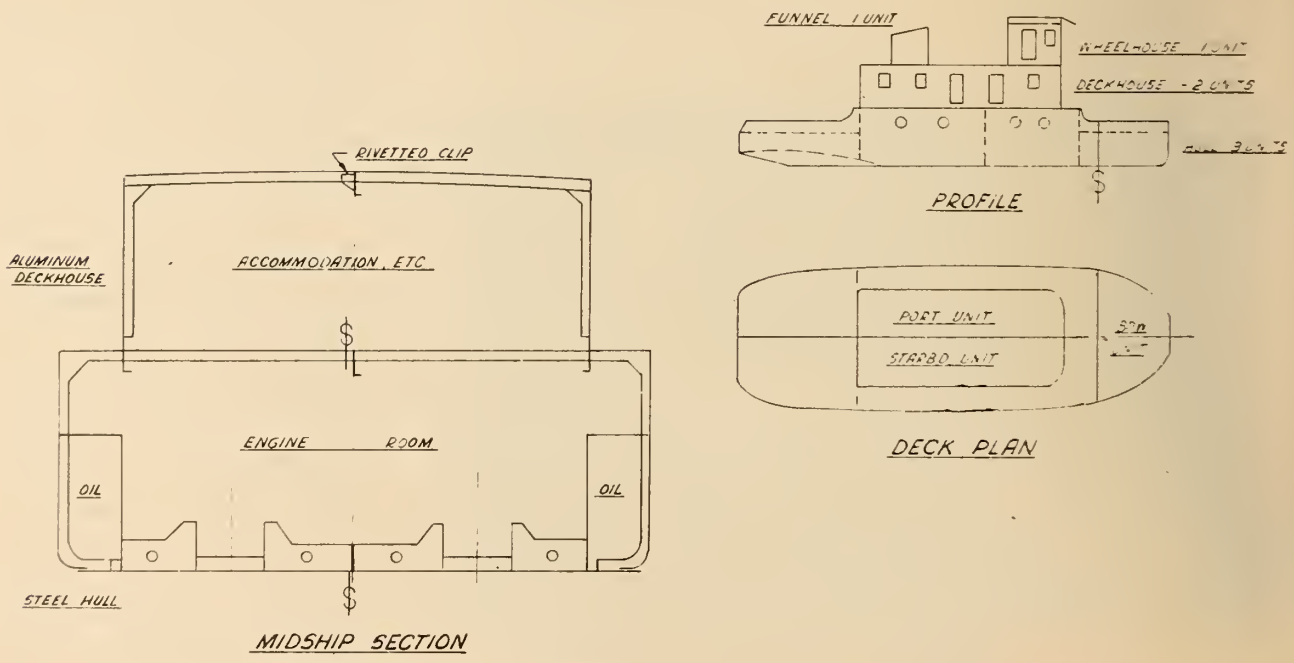


Fig. 4. Twin screw tunnel stern tug, 69 ft. x 24 ft. 6 in. x 9 ft.

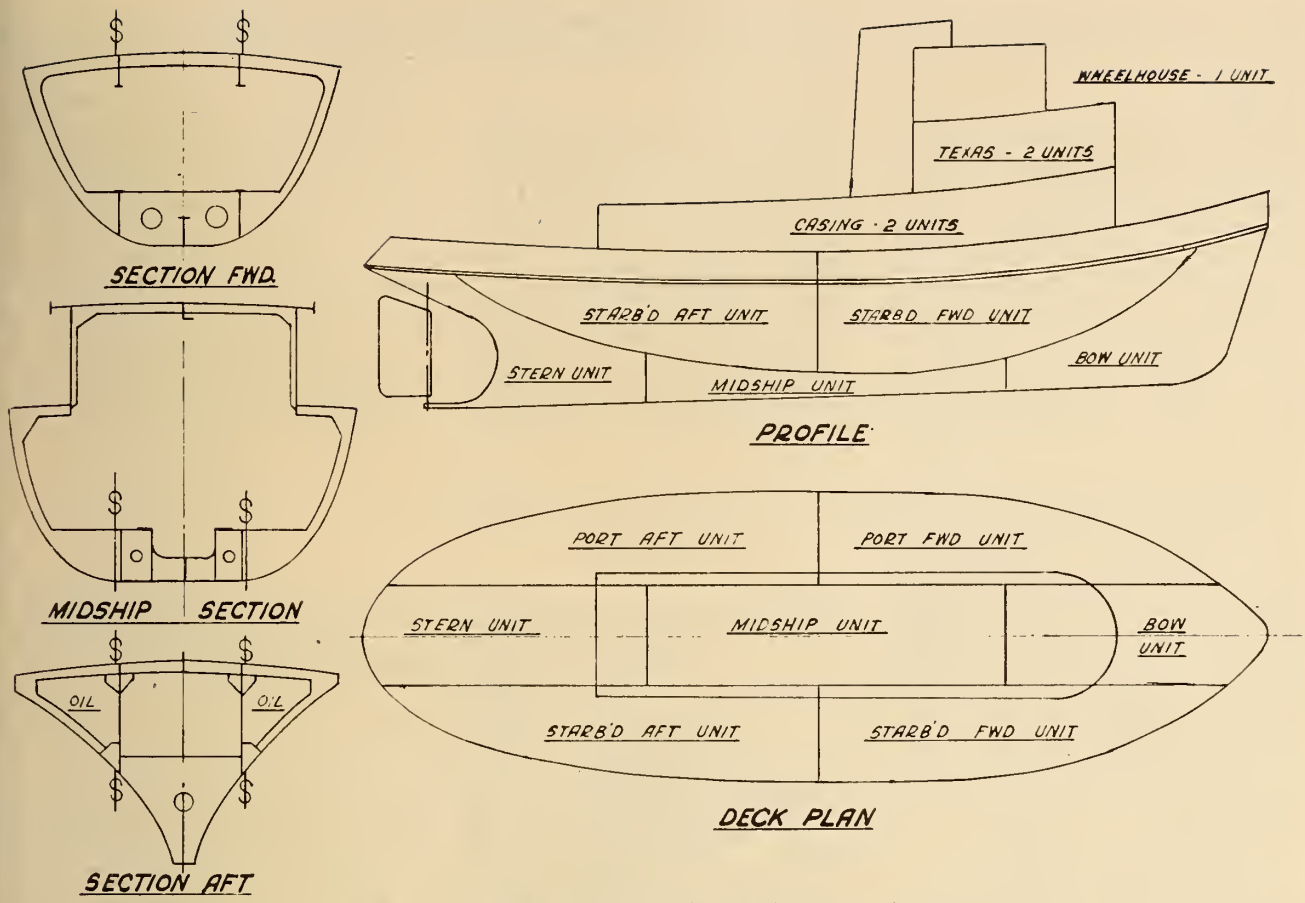


Fig. 5. Single screw tug, 110 ft. x 24 ft. x 12 ft. 6 in.

Rail Car Ferries

Fig. 3 illustrates the general features of a 240-ft. railway car barge. Two of these barges have been built in recent years for the Canadian Pacific Railway, one for service on Slocan Lake, and the other on Okanagan Lake. Both these lakes are long and narrow, and instead of building the railway along the side of the lakes, the trackage has been terminated at landings at each end, the barges being used for transporting cars up and down the lakes. These barges were designed for unit construction.

It will be observed that the transverse section of the barge is divided into three units—the side units consisting of the deck, side shell, bottom plating and longitudinal bulkhead, the centre unit consisting of deck plating, bottom plating, and two longitudinal bulkheads. The longitudinal bulkheads are so located that the railway track centres on each bulkhead, so that the bulkheads provide deep girders for supporting the weight of locomotives and cars.

These units were joined together in the field by fitting steel web plates in line with each transverse frame in the vessel and fitting the small bottom and deck panels. The complete barge consisted of 24 pontoon sections, each section 30 ft. long, approximately 10 ft. 6 in. wide and 8 ft. deep. Each pontoon unit weighed about 18 tons, and it will be interesting to note that, although there is a total of over 350 tons of steel in each of these barges, nevertheless, the only equipment used in the erection was a gasoline 2-drum hoist and two chain blocks. No crane was used whatsoever.

In the case of the barge built on Slocan Lake the railway was adjacent to the launching site, and the sections were skidded off the railway cars down a 20-ft. embankment onto the ways. In the case of the barge built on Okanagan Lake, the cars were unloaded at a point five miles away from the launching site, and all steel was trucked for five miles.

Before these vessels were constructed, a steel railway car barge of approximately the same dimensions, but rather different internal design, had been built for Canadian National Railway service on Okanagan Lake. This barge was built in the form of panels and erected on the launching ways with the aid of a mobile truck crane. The unit construction used on the later vessels cut the field labour to approximately 60 per cent the number of man-hours of the original vessel.

Self-Propelled Vessels

The problem of designing a barge to be built in units is relatively simple as in most cases the designer is quite free to choose his method of stiffening, framing, and general internal construction. However, in the case of a self-propelled vessel the problem becomes somewhat more complex, particularly if the vessel is ship-shaped.

Fig. 4 shows the transverse section of a twin screw tunnel stern vessel built for service on the Bear River in the Northwest Territories. The hull of this vessel was built in three units—the deckhouse in two units, and the wheelhouse as a single unit. The hull consisted of a bow unit and a port and starboard unit. The deckhouse was built in two units divided down the centre-line.

By making the hull in port and starboard units it was possible, since the vessel was twin screw, to fit the engine beds, engines, shafting, propellers, and all other gear in the vessel at Vancouver before shipment north. This enabled all the machine work, lining off, and other

work, to be done under shipyard conditions, leaving only minor adjustments to be done in the field.

As will be seen in Fig. 4, the deckhouse was divided down the centre. However, the main deck was incorporated with the deckhouse section instead of being shipped with the main hull. In this manner it was possible to complete 75 per cent of the furnishing, plumbing, wiring, heating, etc. in the deckhouse sections. These sections were sent out in railway cars complete with berths, tables, stove, refrigerator, etc., completely finished for each section.

The hull sections had practically all the engine piping, fuel tanks, day tanks, heat exchangers, oil coolers, steering gear, etc., installed. The engines were removed for shipment to prevent damage to such vital units. By completing the vessel in units in Vancouver it was possible to complete 75 per cent of the man-hours required for the job in the shipyard, and only 25 per cent of the total labour was spent in the field.

Largest Steel Diesel Tug

Fig. 5 shows the construction of a single screw steel tugboat which was built for Okanagan Lake. In the case of a twin screw vessel, dividing the hull down the centreline is a most expedient method of construction. However, with a single screw vessel the centreline division is practically impossible and another solution must be found. In the case of this vessel, which was 110 ft. long, it was decided to divide the beam of the vessel into three sections. The centre section contained the keel and terminated on a heavy girder running the length of the vessel approximately 4 ft. off the centreline port and starboard.

This heavy girder was a continuous unit from practically stem to stern of the vessel. In the way of the engine room it was incorporated with the engine seating, and abaft the engine room the girder formed the side of the diesel oil tanks. This centreline unit was divided into three lengths—the bow section containing generally the crew's quarters, a midship unit containing the engine seating, and a stern unit containing the fuel tanks, etc. The port and starboard units consisted of the decks, side shell and framing, auxiliary seatings, etc. These units were divided in the middle into a forward and after unit in each case. Thus, the hull of the vessel was constructed in seven units. The casing unit, which also contained the galley was constructed in two units, divided down the centreline.

The texas, containing the officers' quarters, was similarly divided down the centreline. The wheelhouse and the funnel were two separate single units. As in the case of the previous vessel, the main deck inside the casing was shipped along with the casing sections, so that the galley was completely outfitted before the vessel left. The texas units did not have any deck on them. However, the berths, furnishings, wash-basins, etc., were hung complete on the bulkheads before leaving. It will be interesting to note that this vessel, powered by an 800 hp. Washington diesel, is the largest steel diesel tug ever built in British Columbia.

In conclusion, it must be added that in every case these vessels were designed specifically for unit construction, and the design of the vessel was made to suit subdivision for shipment by rail. The success or failure of undertaking this type of work is determined on the drawing board at the time the vessel is designed. √

CONSTRUCTION METHODS ON ONTARIO HYDRO'S NEW NIAGARA POWER DEVELOPMENT

(*Continued from page 1179*)

is now being drilled; and three percussion type drills, drilling 5¾-inch. holes.

For mixing 1,500,000 cu. yds. of concrete on the project, there are: two automatic mixer plants with four 2-cu. yd. mixers in each. One of these plants was the same plant that mixed all the concrete for Des Joachims development on the Ottawa River, and before that mixed concrete for the Shipshaw Development during the war.

There are also, of course, numerous other pieces of plant. Besides this, the contractors on the tunnels are going to have large equipment for their part of the work; in fact, one contractor is mucking the tunnel with 2½-yd. shovels, using a 3½-cu. yd. rock bucket, short boom and loading into 15-ton dump trucks. There is approximately 500,000 cu. yds. of muck to come out of each shaft for each tunnel.

Job Organization

You will be interested also in the organizational set-up for that part of the project being built by Commission forces. The job has been divided into divisions. These are: powerhouse, rectangular canal, trapezoidal canal and intake. In addition there is a mechanical section and an electrical section. There is a superintendent of construction and a divisional engineer on each division, all reporting to a general superintendent and project engineer respectively. The tunnels, being under contract, make a separate division and report through divisional engineers to the project engineer.

To promote co-operation, better production and safety, each division holds a weekly Labour-Management Production Committee meeting. The committee is composed of the superintendent and a limited number of foremen and men. These meetings have been well received by everyone, have created great interest in the work being done, and have been most productive in ideas. Our safety record has been most gratifying so far, and it is believed this has been largely due to our program of making everyone safety conscious. Then once a month we have a Central Safety Committee meeting and, separately, a Labour-Management Production Committee meeting. These committees handle those matters which could not be settled by the Divisional Committees.

As soon as the job was projected some thought was given as to how labour unions would be involved. It was decided that perhaps the best thing to do would be to say that this job was a union job right at the start, but that instead of trying to deal with each trade union, we would ask the unions to form a council amongst themselves with whom the Commission could deal, and make an agreement. This has been done and admittedly it has worked out satisfactorily. It has been particularly helpful in balancing rates amongst the various trades. √

Canada...
Engineering Opportunities Unlimited

by

J. A. Morley

Director of Sales and Service
A. V. Roe Canada Limited, Toronto

An address presented before the 66th Annual General and Professional Meeting of The Engineering Institute of Canada at Vancouver, May 7, 1952.

The author and the chairman of the Annual Meeting session, T. R. Loudon, M.E.I.C. (left), and J. A. Morley.

As an engineer now in the administrative branch of Canada's newly-established jet aircraft and engine field, I have been privileged in participating in the development of something of tremendous significance to our engineering profession and to our country as a whole. Engineers should be interested in our problems and achievements at Avro Canada, because they contain a message and a lesson for Canadian industry as a whole.

It would be fair to say that Canada's fortunate position today in a troubled world is largely due to the efforts of the engineering profession. As short a time ago as before the last war, he would have been an audacious prophet indeed who would have predicted the Chalk River atomic energy development, the exploitation of the Labrador iron ore field, vast oil and natural gas developments in Alberta and Saskatchewan, with grids of pipelines traversing the country, or the realization of the St. Lawrence Seaway project. Here in British Columbia you have the expanding chemical industry, the manufacture of new wood products and their derivatives and to the north—the giant potential of the Kitimat operations.

Canada is today one of the world's most powerful industrial nations, its whole economy having changed its status in less than three decades. It used to depend for its livelihood on primary industries — agriculture, fishing, mining and lumbering. Now it derives its main wealth from the processing of primary products and the manufacturing of a variety of capital and consumer goods. These are necessary for the high standard of living Canada has set up for herself—second only to that of the United States. Canada has become the third most industrialized and trading nation of the world. Since the beginning of World War II, our country has undergone a phenomenal industrial development, doubling our national production and advancing our standard of living 50 per cent.

Gentlemen, as those chiefly responsible for all this, may I ask you if we now intend to rest on our oars? I sincerely believe we would be foolish indeed if we did so, because actually we are on the threshold of a veritable golden age for our country. This should be only the beginning. May I emphasize this point which I later will develop. You engineers who have played a leading role in opening up the country and in indus-

This paper tells how Avro Canada is developing a truly self-contained enterprise for the production of jet aircraft. It shows how by training their own technical personnel, creating originators and leadership, doing all their own design, establishing their own subsidiaries for sub-contracts, Avro Canada is setting an example to Canadian industry of original design and all-Canadian production.

The author believes that if Canada is to develop as a leading world power, Canadian industry generally must develop along similar lines and thus broaden our industrial independence.

trializing it should now be establishing Canada's rightful role as an independent producer of her own designed goods.

This is the logical next step in our industrial growth. As you know only too well by past experience, in our field as in others, you can never stand still. You either go forward or you go back. And the opportunities facing us are truly unlimited. I do not need to tell you that your best efforts are particularly needed in a period of world tension, such as we are experiencing today.

Shortage of Engineering Skills

There are several major problems which we engineers will have to come to grips with, however, before we could proceed with our great mission of developing to its utmost the vast potential of this country. One of the problems which must be uppermost in our minds is the acute shortage of engineering skills brought about by our country's rapid expansion in practically every phase of technical progress. The Department of Labor estimates that by 1954 the demand for graduate engineers at our present industrial tempo will exceed the supply by about 800 a year. Obviously we as a profession must encourage promising young men to enter engineering.

Another associated problem to which we must give serious consideration is the loss of many of our engineers to attractive fields in the United States. Our comparatively higher educational standards for qualified engineers puts them in high demand there. However, it is absurd that when so much of this higher education is paid by the state, and their talents are in such demand in their own country, we do not somehow or other make it attractive for them to stay at home.

Perhaps steps should be taken to ensure that engineers be paid comparably with their confreres in other professional fields. Perhaps industry should consider placing the executive and creative engineer on an equal footing, because of the respective value of their services. Undoubtedly everything possible should be done to promote a feeling of dignity and appreciation of the position of our engineers in the industrial world. I might add that the Association of Professional Engineers has done a fine job, but we must do more individually and collectively.

Technician-Employee Ratio Rising

Among the reasons for the present acute shortage of engineers, which we unfortunately cannot do much about, is the increasing complexity of modern technology. Aircraft manufacture itself is a good example. In 1943 for every specialized radar and electronic job the aircraft manufacturer needed one technician for every 1,000 employees. Today one out of every 24 employees is needed for such a job. At that time, one out of 22 employees was an engineering or technically trained man. Today the proportion is one out of eight.

The individual parts in an aircraft of World War II were numbered in the low thousands, but a typical bomber of today has nearly 140,000 separate parts, each one of which has to be machined or manufactured to the highest tolerances.

It was possible to fill personnel vacancies during the last war in our industry from the ranks of housewives, farmers, drug clerks or filling station operators. Now these positions have to be manned by skilled personnel. As a result the aircraft industry's hiring policy has been most selective, with an unprecedented demand for engineers, scientists, designers and skilled craftsmen.

At Avro Canada, we realize that until the shortage of engineers ends, we will have to compete with other Canadian industries for a relatively few engineers. We do hope, however, that the aims and achievements of our company will attract many young engineers of promise. It is alarming to note that there are only 1,717 prospective 1952 engineering graduates currently registered at Canadian universities. According to Department of Labor estimates, there will only be 1,411 prospective engineering graduates in 1953.

We know the aims of our new jet aviation industry will attract the right sort of engineer for which we are looking. We offer something more than a mere development and production job, but the chance to do useful work in defence and eventually in the peacetime commercial field.

Other industries are providing similar opportunities. It should no longer be necessary for young Canadian engineering graduates to look to other countries for a future career. At Avro Canada we have proved there is ample opportunity for this talent. Engineering skill and all-round ability are also coming to us from the motherland and, interestingly enough in the light of past trends, from the United States as well.

Avro's Training Programs

Because of our huge expansion program, we at Avro Canada are seriously affected by this nationwide engineering shortage. To a certain extent we are trying to make up the deficit by our training programs. Besides a wide program of training in skills and engineering processes, the company is planning a broad program of training in administration, supervisory practices, leadership techniques and the development of creative personnel relationships. In this program we are trying to embody the Western conception of social conscience, with its essential ingredient of a mature, well-rounded personality possessing broad human judgment and social perspectives.

As a development company now rapidly approaching the production stage, we would like to feel that we are the embodiment of the emergence of a strong national awareness. We also feel our responsibilities keenly in the development of native talents of leadership. I think it would be of value if I outlined to you the thinking we at Avro Canada have developed on the place of the engineer in present-day Canadian life.

Like most industries, at the moment, we are concentrating completely on defence work, yet we could, on comparatively short notice, convert to peacetime development work and production. Because of the government's dire need for air power, and because of the importance air transportation has in the nation's economy, we are beyond any doubt one of the most important industrial concerns in the country. Our products, the Jetliner transport, the CF-100 fighter and the Orenda engine, are the first of their types. They have won world-wide engineering recognition. We believe Avro Canada is a good example of a new Canadian industry, largely self-sufficient and of tremendous importance, not only in the national but also in the international sphere.

We have completely rejected the type of thinking which relegated Canadian engineers and their work to a secondary role in world affairs. In the past, and indeed even now, most of Canada's applied science based itself on fundamental research done in Europe. Our best engineers came from abroad and from the United States, while our own superbly trained engineers looked south of the border for their future.

Although, it is true, Avro Canada has a close connection with the Hawker Siddeley Group in England, the largest aircraft and engine manufacturers in the world, we are completely independent, and Canadian. While we get personnel, ideas, equipment and advice from other mem-

bers of the Group, we are also capable of giving them something of our own in return. This is quite different from most Canadian branch plants which are completely dependent upon the head office. We are our own head office, something new for Canadian industry as a whole. We submit this example is worth following.

Leaders Wanted

We would like to feel that the new engineering spirit behind our company has a growing influence on Canadian industry as a whole. We are very conscious, as one of the largest employers of engineers in the country, that we have a social responsibility to the whole nation, particularly because of the defence nature of our work. We now employ 316 graduate engineers of all types, ranging from those in the mechanical, aeronautical, civil and chemical to those in the electrical fields. We estimate during the next two years we will require another 150 and by 1956 some 215 additional in all.

You might be interested in the type of engineer we are looking for to help us in our task. We feel we are ahead of the profession in these specifications. What we want are leaders, supervisors and administrators as well as men whose engineering performance and technical abilities are outstanding. We are chiefly looking for men of ideas, of promise. Our standards are high. They must necessarily be so, if our products are to be competitive with the best the United States and United Kingdom have to offer in the jet aircraft and engine field. We are looking far ahead, but such planning is necessary to shorten the flow time of production and development, and to carry on additional planned projects in parallel.

Secondary Industries Developed

As a further contribution to the development of engineering opportunities, our company has fostered many new subsidiary industries, including the manufacture of turbines and compressor blades, new heat resistant light alloys, fuel systems, bearings, gear boxes and complex aircraft equipment. A network of over 400 individual companies which are engaged in supplying our Canadian jet program at Malton has been set up.

This means that when maximum production is reached about 30,000 individual Canadians will be employed handling various sub-contract work, entirely distinct from our own staff of some 15,000. Naturally we have done much engineering work ourselves, but we have let out some 500,000 hours of design work to Canadian engineering firms. Another 650,000 hours has been let out to various firms all over Canada for work on jigs and fixtures.

Because Avro Canada is a company developing new products, we have built up facilities comparable to any in the world, which would gladden the heart of any research engineer. Much original work is being carried out in the company's own mechanical test, fuel systems, aerodynamic and instrument laboratories. At Nobel, Ontario, there is specialized test equipment for our development jet engines. Our staff have turned out more than 300 revolutionary ideas for various machines and devices to improve the design, development and construction of jet engines and aircraft.

A further example has been set to engineering industry by our contribution to national self-sufficiency. Canada's wartime manufacturing experience as a branch office in the allied aircraft industry was bitter. Often the supply of essential materials or products from the United Kingdom or United States was not forthcoming. One of the direct results of this was the setting up of a self-contained industry capable of designing and building its own aircraft and engines.

Original Design and Development

Today for the first time, we as engineers can be proud that our country is featuring Canadian design, not only of aircraft, but of aircraft engines hitherto not produced at all in this country. That they are built alongside each other is rare throughout the world, and is something to be proud of. Avro Canada's network of suppliers and sub-contractors stands ready in case of national emergency, and as a nucleus for the continued peacetime development of the Canadian aircraft industry. Our company, you must realize, is much more than an arms factory. We are continuously thinking and planning for the more constructive task of improving our country's industrial and economic peacetime potential.

There are, unfortunately, few such programs of original design and development undertaken in Canadian manufacturing. Avro Canada is a prime example (and one which we hope will be followed widely) of our country's economic expansion and high productivity based upon engineering contribution. The Malton enterprise should not only contribute to peace and security. It should bring a greater abundance of material goods and comforts to all Canadians.

If our country is to achieve its splendid destiny in the international sphere, we engineers, whether we work in industry or not, should do more of our own research, so that Canadian products can stand up to international competition. As you know, our trade abroad has a leading importance in the nation's economic make-up. It is a tragedy when our country is forced to import scientific ideas, particularly when this import business is complemented by the export of scientific brains. If this trend were permitted to get out of hand it would leave this country in an extremely vulnerable position in time of war. A start undoubtedly has been made, but we Canadians yet have to walk on our own two feet, industrially speaking. At the moment we are being led by the hand by other countries in too many fields of engineering endeavour.

Recognizing the need for industry and science to do original work, our government set up the National Research Council. This has done magnificent work in stimulating independent research work in our country. Many scientific organizations, such as The Engineering Institute of Canada, the Royal Society of Canada and the Chemical Institute of Canada are also fostering original scientific thinking. Canadian industry as a whole is training its engineering and scientific personnel, and there is no doubt that, if this training is properlyc arried out, it could foster creative achievement.

Making Canada Industrially Independent

Our engineers and scientists have proved they can produce outstanding work in the industrial field. To a certain extent we have already shown we can develop goods of our own, and not be wholly dependent upon imports. We have also proved we can manufacture these goods as effectively as the United States and, what is more, sell them on a competitive basis.

We are producing today a large number of commodities or parts formerly imported from the United States. Goods completely produced in this country and formerly imported from jet engines to tapered roller bearings, from vinyl sheeting to lace, from two-speed differentials to pyrex nursing bottles, from ethylene glycol to food extracts.

As a result of efficient low cost production in Canada, we are now

(*Continued on page 1210*)

RAILROAD CAR LIGHTING

Past and Present

by

J. W. Sharpley

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Canadian Pacific Railway Company, Montreal.

This paper traces the evolution of railway car lighting, from the candles used in the first early nineteenth century coaches, through oil lamps, Pintsch gas, electric lamps of the "eighties", down to the indirect and fluorescent lighting in use today. Modern improvements in lighting were made possible by the introduction of air conditioning in post depression years.

New dining car services—refrigerators, toasters, dishwashers, garbage grinders — as well as train movies, day nurseries, full air conditioning, ranges, etc., call for 60 kw. and upwards per dining car, and even up to 500 kw. for a 15-car passenger train. The current trend is towards diesel-engine-driven power plants mounted under individual cars.

Railroad car lighting has taken some remarkable strides forward in the last fifteen years or so. Before considering the present, however, it might be interesting to take just a glance at the past.

The illumination of passenger cars had been developed from a crude beginning, the first known attempt at car lighting being made in England in 1825. In that year, the first passenger-carrying vehicle for railroad work was built for use on the Liverpool and Manchester Railroad. This car was horse-drawn, had seats to accommodate six or eight passengers, and was operated between Stockton and Darlington for several years.

The passengers were provided with candles for illumination on dark nights, and they were required to attend them themselves. It was nothing unusual for the candles to fling their dripping tallow on to the best of clothes. Later, a table was placed in the centre of the car to hold the candles.

As the number of passengers increased, lighting methods improved. The first improvement was sockets placed on the sides of the car to hold the candles, chimneys being supplied to protect the flame. A coiled spring was used in the bottom of the holder to force the candle up as it burned away, thus maintaining the flame at a predetermined position. This type of candle lamp is still in use on mail cars as an auxiliary light in case of failure to the primary lighting system.

The use of candles continued until the introduction of oil lamps about the year 1850, although there is record of some swinging oil lanterns burning whale oil having been used as far back as 1840. By 1870, the lengthened cars were provided with stoves at both ends, and with kerosene lamps hung from the ceiling in brackets specially designed for car service.

The first oil lamps were a development of the improved candle lamps. They gradually developed into the modern centre draft burners, but their doom was sealed from the first trials of the Pintsch gas lighting system, which took place in 1881. In 1883 there were nearly 200 cars equipped on Eastern roads. The Foster Gas Light and the Frost System, using acetylene gas, were worked out between 1880 and 1885. The Pullman Company and most roads, however, used the Pintsch gas system, on account of its reliability, greater safety, and the increased storage capacity obtained by carrying the gas under compression in the tanks.

The first gas lamps were of the flat-flame or fish-tail burner type. The mantle lamp was at first unsatisfactory, but suitable material was soon found, and this type of lamp was used extensively for car lighting purposes. At the present time, both flat flame and mantle lamps are still in use in some of the older types of passenger equipment. An ignition system for lighting the gas lamps was also tried, but did not prove successful, due to the globes and mantles shattering when gas was allowed to remain on too long before spark was applied.

First Electric Lighting

Experiments with electric lighting began around 1884, and before 1890 a successful lighting system was in use, in which power was taken from a generator in the baggage car. It is said that new cars purchased from the Pullman Company in 1887 by the Atlantic and Grand Trunk Railways, for operation between Montreal and Ottawa, were the first cars in Canada equipped with electric lights. It was not until 1905, however, that electrically lighted cars were introduced on a large scale. Development then proceeded

until the car shown in Fig. 1 was reached.

Three general methods were developed, all of which are in use today. These three methods are: *Storage Battery System*—in which the current is supplied exclusively by storage batteries; *Head End System*—in which current for the entire train is obtained by use of engine or steam turbine generating set; *Axle Generator System*—which provides lighting for each car as an individual unit.

The straight storage system, as the storage battery system is now termed, is the simplest method of car lighting, but is not now considered flexible enough for general service.

The head-end system, where the entire train is lighted by a generator at the front end, was the next development in car lighting. This was accomplished by several methods:

1. A generator in the baggage car, belt-driven from the car axle, using a storage battery auxiliary when the train stopped. A mechanical device served both as a pole changer and automatic switch, the batteries being depended upon as a regulator.
2. A generator on the locomotive, driven by a steam turbine.
3. A generator in the baggage car, driven by a steam turbine or gas engine.

The axle generator system was developed about the same time as the head-end system, and was of the head-end type, but later individual units were applied to each car.

One of the first practical types of equipment on record used the slipping belt for regulation, and was the only one of its kind. A complete installation for a coach consisted of a generator and two sets of storage batteries, suspended on the underframe of the coach. When the lamps were burning and the coach was stationary, the batteries supplied the light. When the coach was running, the generator supplied the lamps through a small resistance, one of the batteries also receiving a small charge, the other acting as a regulator.

One of the principal features of this system was to prevent the output from exceeding a required amount regardless of the speed of the train. This result was obtained by suspending the dynamo by one corner of its frame by means of an adjustable link, in such a manner that the dynamo was free to swing towards or away from the driving pulley on the axle. The suspending link was adjusted so that the driving belt drew the dynamo out of the diagonal position in which it hung, thus putting a definite tension on the belt sufficient to absorb power for the electricity required.

Fig. 1. Arrangement of electric car lighting in general use between 1905 and 1935 on Canadian railroads.

By means of a rocking arm, the dynamo always supplied current in the same direction, regardless of the direction in which the train was travelling. A centrifugal governor on the armature spindle automatically connected the battery, first to the field magnet coil and then to the dynamo brushes. A resistance sufficient to prevent the lamps being over-run was then inserted in the lamp circuit.

Regulators and Storage Batteries

A later system, still in use, consisted of a generator, belt-driven from the car axle, a generator regulator, a lamp regulator, and a set of storage batteries. The regulator comprises a combination of current and voltage control, which gives a taper charge to the battery. Starting the charge of a fully discharged battery, the current is held constant at a value of about the full output of the generator.

As the charge progresses, the value of the current is slightly decreased, due to strengthening of the voltage coil as the battery voltage rises. As the counter-electromotive force of the battery rises due to its being charged, the generator voltage will automatically rise with it in order to maintain current to the battery. This continues until the voltage has risen to approximately 38 volts for lead batteries and 43 volts for nickel-iron batteries.

Fig. 2. View of modern passenger coach showing application of more recent developments in lighting practice.

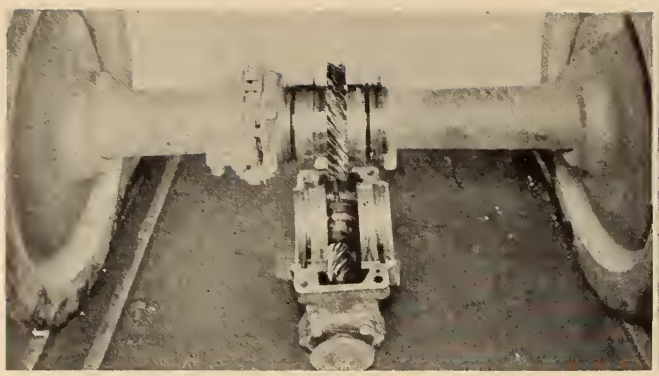

Fig. 3. Car axle and wheel assembly illustrating positive drive unit using worm gearing.

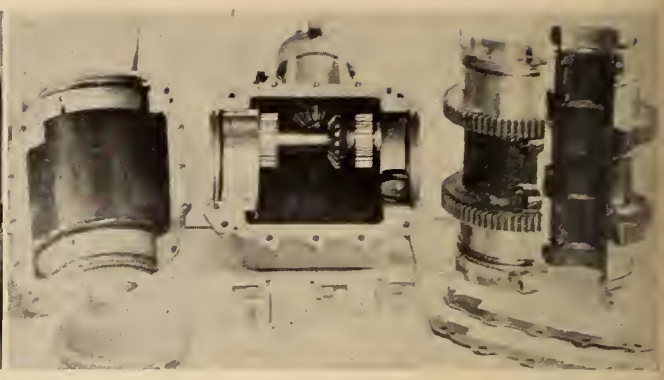

Fig. 4. Expanded view of combination spur and bevel gears used for positive drive of car generator from axle.

The voltage regulating coil then becomes the controlling factor in the regulator, and holds the generator voltage constant; as the voltage regulating coil will not permit a further rise in voltage, the amount of current which can be put through the battery decreases. When the battery is fully charged, the current has decreased to a few amperes. The lamp regulator consists of one, two or three piles of carbon discs and an electromagnet, and is adjusted to maintain a constant voltage from a minimum load to the full capacity of the regulator.

The generator is usually a three-kilowatt forty-volt machine and the battery 400 ampere-hours. These generators deliver constant voltage over approximately a four-to-one range in speed, so that their physical size exceeds that of a three-kilowatt constant-speed machine. Also, they are totally enclosed, which also increases their size.

The method of coach lighting (Fig. 1) remained more or less unchanged until about 1935, when the application of air-conditioning necessitated a radical change being made. The lighting fixtures in Figure 1 are mounted approximately one over every other seat for the entire body of the car. The shades are of the open-mouthed glass type, well designed for light distribution, sending most of the light downward while still allowing enough to go upward to illuminate the ceiling properly.

The thought naturally arises, "Why did this system stay so nearly the same for practically thirty years?" One reason is a progressive improvement in the efficiency of the lamps used, which approximately doubled the light output during this period. Another reason is that flat belts used for driving the generators from the axles will not satisfactorily drive generators over five kilowatts in capacity, especially where snow and ice are encountered.

Air Conditioning Calls for New Methods

During the latter part of the "twenties", it became apparent to most North American railways that in view of the demand by the travelling public for better car lighting and the need for some method to air-condition the cars, the old method of driving generators through belts and axle pulleys was insufficient to take care of the larger generators needed.

The railways, seeing the need for a positive drive unit, contacted certain manufacturers, with the result that positive gear drives (Figures 3 and 4) came into being, and over the years have improved to such an extent that, where the driving of generators was a major problem, today the lighting failures attributed to this cause are few.

From about 1935, air conditioning was introduced on a large scale, the ice-activated system being first adopted, followed by the so-called electromechanical system. In the latter system, the air-conditioning compressor is motor-driven, hence its name. Because of the power required by this compressor, the generator capacity had to be increased to 20 kw. at 40 or 80 volts, and the battery to 16 cells of 1,200 ampere hours' capacity for the 32 volt equipment, four times as large as the battery formerly used.

The large generator and battery made possible a substantial increase in the lighting, and it was possible to make this increase without charging any expense to the lighting, except that of new fixtures, when used. This increase in lighting was secured by providing a 25-watt lamp over every seat. Figure 2 shows a new coach relighted with this arrangement, and built in recent years.

Part of the pressure for increased lighting came from the greater cleanliness of the air-conditioned cars, as it is only natural to expect lighting to be in keeping with the general appearance of the car interior.

Indirect Lighting

It is difficult to keep fixtures clean on cars in which cinders and dust are prevalent, and dirty fixtures discourage improvement in lighting. Several means have been used, such as louvers, particularly in continuous-type trough fixtures, and plastic shades. Indirect lighting has also been used. Indirect lighting alone, however, is not very efficient for car lighting when compared with direct lighting from well-designed fixtures.

It is agreed that the best location for lighting fixtures in coaches is under the baggage racks (Fig. 2), if suitable supplementary lighting is provided to give adequate ceiling illumination. This location brings the lights close to the reading plane and also permits individual control by the passengers. This arrangement, however, is seldom feasible except on new cars, because of the cost of installation.

With air conditioning and modern lighting, reclining seats also were introduced on a large scale. With these came a demand for reduced lighting for use late at night, to permit passengers to sleep without being disturbed by the bright lights. A number of arrangements have been used for this purpose, such as dimming some of the main lighting units with the others extinguished, small additional fixtures being installed especially for the purpose, and the use of an auxiliary low-wattage lamp in the main fixtures, usually blue in colour.

For night lighting, the body lights are extinguished and the blue lights alone used for illumina-

tion in the body of the car. Platform, salon and passageway lights are left unchanged, but shields are provided where necessary to prevent direct glare. Improvement of the body lighting led to an increase in the lighting in washrooms and salons, while the use of air-conditioning led to improved ventilation by installation of exhaust fans.

Not only has the total regulated load increased, but also the loss in the lamp regulator, which, in turn, requires improved ventilation of the regulator lockers. Even with the large-sized batteries used on air-conditioned cars, the effect of these high-lighting loads becomes noticeable. In short, the increased lighting load required by modern lighting indicates the desirability of a source of light more efficient than the incandescent lamp. the only type so far considered.

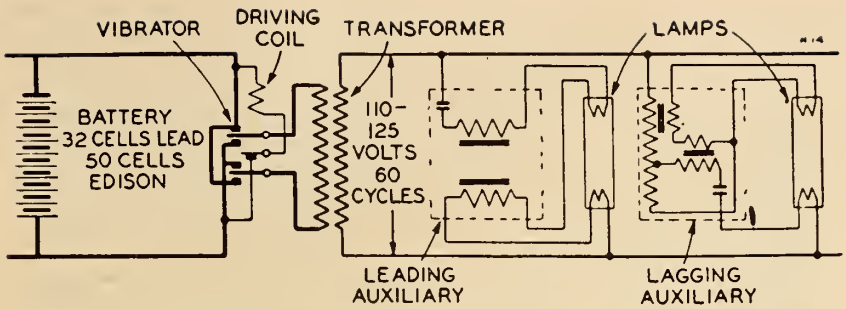

Fig. 5. Wiring diagram for "constant load" type of vibrator inverter.

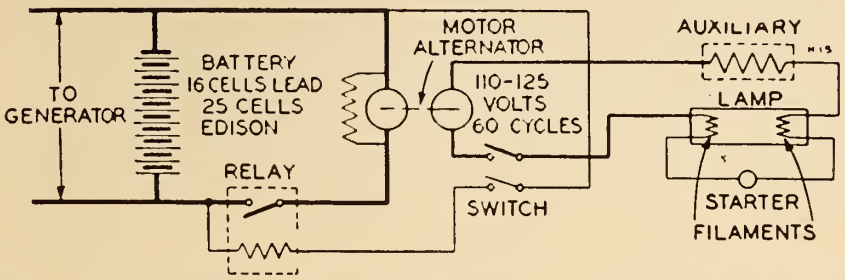

Fig. 6. Motor alternator wiring connections as used in railway car lighting.

Fluorescent Lights

Fluorescent lamps were first placed on the market about 1938 and have had widespread acceptance for many uses since that time. The possibilities for power saving are immediately apparent. For instance, an 18-inch by 1½-inch (T-12) 3,500-degree white fluorescent lamp with 15 watts input to the lamp and about 5 watts loss in the auxiliary or a total input from the line of 20 watts gives about four per cent more light than a 40-watt incandescent lamp. Exclusive of conversion losses, the power required can be cut in half for approximately the same light.

The advantage of this type of lighting is the more even distribution of light obtained than with the incandescent lamp, due to the larger source of illumination. Also, the effect of voltage variations on light output is less than with the incandescent lamps, a one per cent voltage change making a 1 to 2½ per cent change in the light from a fluorescent lamp, whereas it makes a 3½ per cent change in the light from an incandescent lamp.

Fluorescent lamps, however, have some disadvantages, such as the lamps not lighting or staying lighted below a certain voltage, also lamps operated on a-c circuits are sensitive to frequency variations, 58 to 62 cycles being accepted as the standard range. Fluorescent lamps were designed for operation from an a-c supply only when first brought out. Therefore, for car lighting, some device was required to convert from direct to alternating current, and most of our problems have been associated with conversion devices.

At present, two methods of changing direct to alternating current are used; vibrators or motor alternators. Figure 5 shows one type of vibrator inverter installation known as the "constant load" type, in which no provision is made for turning off individual lamps. These inverters have a relatively high efficiency of approximately 70 per cent.

Figure 6 shows the connections of a motor alternator, which is merely a small motor-generator set having a single-phase generator. The set is provided with inherent regulation of voltage and speed, and standard commercial auxiliaries are used with the lamps. Because of the simplicity and ruggedness of these machines, quite a number are in use, although efficiency is less than that of the vibrator inverter, the efficiency being 60 per cent at full load and less at light loads.

It may be noted that both the above systems eliminate the lamp regulator, which helps to improve the efficiency. The efficiency can drop to approximately 38 per cent before the input of a fluorescent lamp installation will equal that of an incandescent lamp installation for the same amount of light.

Fluorescent lamps will also operate successfully on direct current. However, the range in voltage over which such lamps will operate is somewhat limited. With the voltage on the so-called 64-volt system actually varying from 56 to 90 volts when using Edison batteries, it was found necessary to develop a new size lamp to secure one that would start and operate on voltages down to 55 volts, which is considered as the lower limit of required operation.

Over the past twelve or fourteen years, a large number of passenger cars have been equipped for fluorescent lighting, including operation of conventional types of fluorescent lamps in series, using cold cathode starting, and also with the use of neon tubes. One railroad which has ordered over 400 cars since the end of the last war has used 60-volt d-c fluorescent lighting, but the majority of other railroads have used the 60-cycle, alternating-current fluorescent lighting.

Post-War Improvements

As coaches constitute a large part of passenger-carrying rolling stock, they are being discussed, for the most part in this article. The levels of illumination provided in passenger cars previous to 1936 were, in general, considerably below that of dining and other special types of cars. Furthermore, the lighting of cars other than coaches is often influenced to a much greater extent by the desire to apply architectural and decorative treatment to the lighting.

Immediately after the close of World War II, the railroads began to order a large number of passenger cars in a determined effort to retain a large part of the passenger business which had come to them during the war years, when the use of private automobiles was severely restricted. This building program was foreseen during the war and insofar as was possible, our engineers

and the manufacturing companies planned for it.

As might be expected, a number of different ideas were given a quick tryout and adopted by different railroads. All of these ideas had as their basis a large increase in the amount of power which would be required for electric devices on the cars. Air-conditioning equipment was specified, with greater tonnage capacity available if it should be needed to take care of the increased quantities of fresh air required to cope with the smoking problem in coaches. Some railroads have experimented with electrostatic type air filters, but as yet no widespread applications have been made.

Water coolers capable of cooling from 3 to 5 gallons of water per hour have been installed in practically all new coaches. Some sleeping cars also have been equipped with water coolers, incorporating a circulating pump to supply water in each compartment, roomette or bedroom.

Public address systems have been supplied on coaches, so that stations can be called over the loud speaker system and other important events announced. Some cars have been wired for the wire-recorder. Equipment for radio-broadcasting reception has also been installed.

In keeping with the policy to provide the maximum degree of comfort to passengers, consistent with economy, experiments are being made regarding the development of new types of dining cars with electromechanical refrigeration for such diverse items as frozen foods, meats, fish and beverages. The use of frozen foods speeds up the preparation of meals considerably.

New Services Need More Power

The Canadian Pacific Railway, at the present time, is constructing a new dining car in the Angus Shops at Montreal, equipped with a 30-kw., 230-volt, 60-cycle, 3-phase diesel-electric undercar power plant, which will supply power for electromechanical air-conditioning. This plant also feeds four refrigerating units in the kitchen, electric toasters, intake and exhaust fans, an electric dish washer and outlets for fruit juice extractors. A stepdown transformer is used for fluorescent lighting throughout the car.

At least two railroads in the United States are experimenting with full-scale electric cooking, with the idea of improving service and reducing temperatures in the kitchen. Garbage disposal units are also being used by a number of roads. With a view to further speeding up work in the kitchen, electric dish-washing machines are being installed.

At least one railroad has equipped dining cars for the showing of movies between meals. Cars on certain American trains are also being equipped with nurseries. They are furnished with sterillamps, sunlamps and other health-preserving features to insure the comfort and sanitation of the younger travellers. Sterillamps are also being used in water coolers and other outlets on the train.

All of these devices call for increased generator capacity on cars. One all-electric diner has a total maximum generating capacity of 66 kw. Conventional dining cars, however, are being equipped with two generators having a maximum capacity of 50 kw. Coaches and sleeping cars are being equipped with generators of 20 to 35 kw. maximum output.

A large number of these cars are equipped with 1,700 ampere-hour capacity batteries for the 32-volt system. The axle-generators or genemotors as they are called, are equipped with alternating-current motors, so that they can be supplied with external power in yards and terminals while the car is not in motion and for battery recharging. These alternating-current motors are all 220-volt, 3-phase, 60-cycle, a standard followed by all railroads concerned in the United States and Canada.

Heavy Drag on Locomotives

In the Eastern United States, most of the new cars are being equipped with axle-driven generators. In the West, where the railroads have to contend with long grades, which require full locomotive power output for traction purposes, many have adopted engine-driven generators for lighting, and engine-driven compressors for air-conditioning. Most of these units use propane fuel.

The larger generators on many of these cars are driven by a gear unit, consisting of a hypoid gear mounted on a quill which rotates on antifriction bearings. The gear drives a hypoid pinion which is also mounted on antifriction bearings (Fig. 7). When a motor-generator set is used, an automatic clutch is provided in place of a simple safety clutch. This clutch engages and releases automatically. It engages when the drive shaft from the axle of the car is rotating at approximately 280 r.p.m. This type of clutch permits the motoring of the generator by means of the a-c motor mounted on the same shaft.

Most railroads require that any passenger car be capable of carrying its air-conditioning load for at least two hours, independent of any outside power source, which requires a

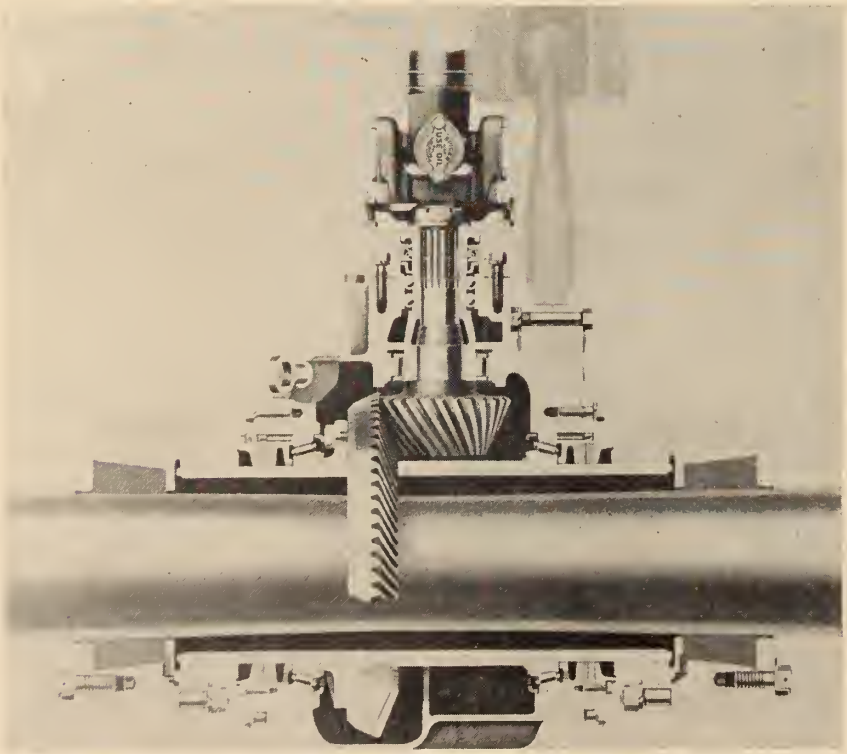

Fig. 7. Sectional view of generator drive using hypoid gear and pinion with antifriction bearings and clutch.

relatively large battery. These batteries must be charged at a relatively high rate, while the car is running, putting a heavy drag on the locomotive. For example, a 15-car train may require as much as 600 h.p. from the locomotive for the electrical power taken by the cars. This is an appreciable percentage of the locomotive rating for normal operation.

On some railroads, the variation in the number of cars that have to be hauled by the same locomotive in different trains may be so great, that no credit can be given to a self-contained power plant for the saving of locomotive horsepower.

On the other hand, where trains of the same length are hauled by the same locomotive day after day, the saving in locomotive horsepower can be credited to the self-contained power plant. The trend, however, appears to be toward the use of single engine-driven units for the supply of electro-mechanical air-conditioning, fluorescent lighting and all other power services on the car.

Having long realized the advantages of induction motors for use on passenger cars, instead of commutator motors, the advantage of a-c power has been forcefully brought to the attention of the railroads by other innovations, such as fluorescent lighting, electric razors, radios, public address systems, sound movies, etc.

Diesel Driven Power Plants

Since diesel fuel has become available on most railroads, attention has turned to diesel-engine-driven power plants that can be mounted under the car. Several manufacturers are developing or have produced units for undercar mounting. Advances made during the last war in the design and building of reliable small engines, and also advances made in design and construction of a-c generators and the voltage-control components, have made this possible.

The following description covers one type of undercar diesel-driven power plant, produced by the General Electric Company and used on their "More Power to America" train.

The power plant mounts under the passenger cars to supply power for lighting, air-conditioning, electric heat and other electrical loads. By special adaption, recovery of exhaust-gas heat and jacket-water heat can be installed to augment the electric heating units. These power plants will operate in parallel with other duplicate power plants in the train. The alternators are designed so sets may be paralleled automatically without pre-synchronization.

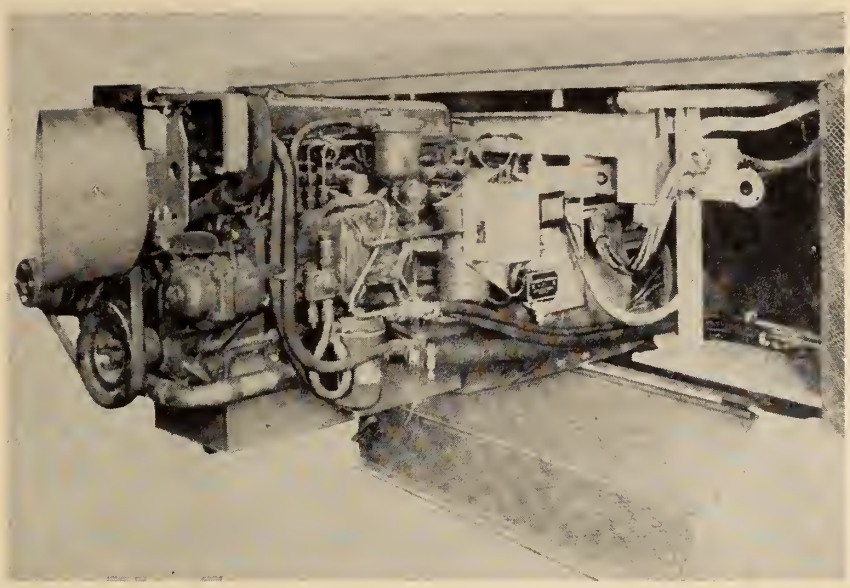

Fig. 8. View of 48 hp., 6-cylinder, diesel-engine-driven power plant arranged for undercar mounting.

The box which carries this unit has a sound-insulation lining, and is fitted with shock mounts at the points of support to the car to reduce noise and vibration. Included in this box is a steam coil, which is connected to the steam trainline and is used during standby in cold weather to keep the power plant warm and facilitate starting.

The engine is a Buda-Lanova 6-cylinder, 4-cycle, 48-h.p., 1,800 r.p.m. machine, with engine governor having 6 per cent regulation to permit bus line operation. The alternator is direct-connected to the diesel engine and is a 4-pole rotating-armature machine with a net output of between 27 and 30 kilowatts (Fig. 8). Overhung from the alternator is an amplidyne exciter, used solely for supplying alternator excitation. It is controlled by a static-type voltage regulator.

This entire power plant is controlled from a simple three-position control station. Engine cranking is automatic, being stopped when the engine starts or at the end of thirty seconds. A 200-ampere-hour, 32-volt battery is used to provide d-c power for engine cranking, control circuits and a limited amount of emergency lighting.

A rectifier-type battery charger provides continuous charging from the 230-volt, 3-phase load bus while the plant is in operation. The (engine-cranking) time delay relay is a magnetic-pneumatic-type relay providing 30-second time delay on pickup. Its normally closed contacts de-energize the cranking contactor if the engine fails to start in 30 seconds.

With the exception of dining cars equipped for full scale electric cooking, and cars equipped with nurseries and entertainment, the author has traced the development of car lighting as carried out by the Canadian Pacific Railway with which he is connected.

Other railroads have progressed along similar lines but to describe all the types of installations that have been made would require a book, not an article. Practically all the new installations have been fully described in either the Railway Age or the Railway Mechanical and Electrical Engineer.

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THE PUSH BUTTON FACTORY

by

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

Six years ago, two Canadian physicists, Eric W. Leaver and Dr. J. J. Brown, wrote an article for *Fortune* magazine showing how electronic controls, developed for military use might be used to control factory machines and processes. Such application could thus make possible the push button factory of the future—the automatic factory—where all work would be done by machines without operators, where the only attendants would be observer-technicians.

They devised an automaton, a hand-arm device, directed and controlled by a punched paper tape, which would automatically load, operate, and unload the machines. They proposed devices to inspect, move and assemble parts. They indicated how, with a new set of tapes and a little rearrangement, the plant might shift from one product to another — for example, from vacuum cleaners to electric motors.

The automatic factory has become one of the most challenging subjects of discussion in engineering and management circles today. The last issue of *Factory* magazine was devoted to it. Even the Russians have climbed on the bandwagon. In February, the U.S.S.R. Information Bulletin printed a somewhat vague article which purported to describe "The World's First Automatic Piston Factory". This was, of course, proclaimed another Russian first. The fact that a group of "capitalist" Harvard students had demonstrated in some detail eight months previously how such a factory might be built was not mentioned.

Automation Dates Back to 1784

Actually, the idea of automation is nothing new. It is the logical and ultimate result of imaginative methods study and uninhibited machine design. Anything which substitutes mechanical, electrical or other devices for human guidance and control is a form of automation. The automatic feed or cam which advances the tool and the template which guides it, the pneumatic cylinder which clamps, indexes or positions the work, the hopper which feeds the machine, the conveyor which takes the finished work away, the elaborate electronic device which directs, co-ordinates, controls a series of complex operations—all these are examples of automation, and as such are steps toward the push button factory.

No engineer should fail to read Professor Shallenberger's challenging paper. Discussing the growth of "automation" over two and a half centuries, the author shows that its adoption by industry has been slow, and cites various retarding influences. Much wider future application is forecast, mainly through the use of electronic devices. This, he predicts, will greatly increase the demand for technicians, but will produce far more jobs then it will displace.

Future emphasis will be on plant maintenance, sales effort, stable markets. Wider fields lie ahead, beyond manufacturing; in the office, in shops, in transportation, on the farm. Widespread application, he believes, might well help to stabilize our entire economy.

The term "automation" is of post-war vintage. To discover its beginnings, however, we must go back even before there was any real American industry, to 1784. This was the year when Oliver Evans built the first mechanized factory just outside Philadelphia, a continuous flour mill. This mill incorporated all three basic types of powered conveyors in a continuous production line, unloading the grain from boat or wagon and processing it to finished flour without human aid. In 1833 biscuit manufacturing was mechanized in the "victualling office" of the British Navy. In 1869 endless monorails were introduced into the meat-packing industry. These were designed for *dis*assembly of hogs, but they were the forerunner of the modern mechanized assembly line.

Henry Ford first used progressive assembly on a powered conveyor in 1914, the same year in which he offered $5 for an eight-hour day in an industry where $2.40 for a nine-hour day was standard. That he was successful in doing both is indicated by the fact that his original investment of $28,000 grew to three-quarters of a billion dollars by 1927.

Many process and chemical companies achieved a considerable degree of automation in the twenties. So did manufacturers of such products as electric light bulbs, cigarettes, bottles and tin cans. The most dramatic of all was the A. O. Smith Company, which in 1920 built an automatic factory to make automobile chassis—a plant in which strip steel was blanked, formed, assembled, riveted and painted, producing a complete chassis every 10 seconds, ultimately 10,000 per day. The few workers present served not as producers but as observers and trouble shooters. A more recent milestone was the construction in England in 1948 of two machines to produce radio sets automatically.

Changing Emphasis

But automation is not limited to completely automatic plants. The automation of segments of industry and of individual machines is much more widespread. It is much the same in its economic and social effects. The lathe was little more than a wood-working novelty until

it was given a mechanical hand to hold the tool. Henry Maudslay in 1797 gave it the lead screw, in effect a cam to control the movement of the cutting tool along the work. Today we have the automatic screw machine on which cams advance the stock, change spindle speeds, index and feed the tools to the work.

The same story may be repeated for automatic drilling and milling machines, for punch presses which feed automatically through progressive dies, and for grinders which feed and eject stock and adjust themselves automatically for wheel wear. We have machines guided automatically by templates, and even some guided by a line on a blueprint. During the war we witnessed the development of the transfer type machine, which combined both machining and materials handling. Raw forgings entered at one end and emerged as finished cylinder heads at the other. These were actually a number of machine units automatically coupled together and centrally controlled.

As machines become more automatic, emphasis shifts to materials handling. The word "automation" as originally coined at Ford, means automatic transfer of parts between machines. Ford has had an automation department since 1947, and one has only to look at the "iron hands" which load and unload mammoth presses, conveyors which carry cylinder blocks through complete processing without human direction, hoppers and chutes which load grinders or other machines and transfer devices which carry forgings through successive press operations, to realize the effectiveness of this department's efforts. Machine time seems destined to be greatly shortened by current developments in metal cutting techniques and coolants. In many instances machine time has been eliminated altogether by die casting, investment casting, shell molding and powdered metallurgy. The result will be an even greater relative emphasis on the automatic handling of materials.

Inspection has also been automatized extensively. Automatic devices count, inspect and sort by weight and color and dimension much more rapidly and reliably than any human could do. They check performance, seek foreign metals or internal defects, detect over- or under-filling of cans and bottles. Both Ford and De Soto have crankshaft balancing machines which measure out-of-balance condition, then automatically drill out enough material from the right spot to remedy it. This will be characteristic of the automatic plant; inspection devices will not only detect defects but will remedy them or pass the information back to previous machines to avoid repeating the error.

Assembly operations have not been so extensively mechanized, although we have continuous brazing, welding, automatic riveting, nailing, cementing, filling containers, packaging, painting, plating, and the like. Leaver and Brown described in general terms a machine to assemble a telephone receiver automatically.

Armed Forces Point the Way

The great dream of the future is *electronic control.* Why, we are asked, can't electronic devices developed by the military to control the flight of aircraft, to guide unpiloted missiles, to direct the firing of guns, be used to control industrial processes? We have devices which can see better, hear better, measure better than humans. They are more reliable, more powerful, more precise, think and move faster than human operators. They never tire, will willingly work around the clock, don't make mistakes, don't talk back, are obedient and fully predictable, have few personal problems and they won't go on strike.

Actually, many electronic devices are already in industrial use. There are simple circuits which through a sensor unit, such as a photo-electric cell, pick up an impulse, amplify it and pass it on to an effector unit, such as a valve or motor, for appropriate action. There are the complex computers and servo-mechanisms which can solve involved equations and translate the solution into automatic control of complex processes. There are others which can translate and use information fed in on a tape or card.

It is the ability of such devices to think, choose, and remember, to move accurately and with great speed that makes them the key to the factory of the future. One of the most important characteristics of electronic controls is their ability to utilize the principle of "feedback". This is a sort of built-in supervision, which insures that the unit has carried out the orders exactly as they were given it. Thus tolerances become a problem of little consequence. The versatility of electronic controls is almost without limit—there are few if any production jobs which they could not perform.

Defense demands are leading to electronic controls which are much more reliable and less expensive. New developments in miniaturization; in printed circuits (which in themselves offer tremendously fascinating possibilities for automation); in circuits imbedded in plastic; in transistors, which will substitute for vacuum tubes, traditionally the least reliable electronic component; and in unitized circuits, in which whole plug-in segments can be readily replaced; with these, electronic controls can be as reliable and as easily maintained as the machine itself.

Adoption has been Slow

To me the striking thing about automation is not what can be done in the future, but rather how little has been done in the past. There are thousands and thousands of jobs now performed by human workers that could be performed more accurately, more efficiently and much more cheaply by automatic means—using devices which are already available.

Why haven't industrial engineers taken greater advantage of these opportunities? The answer seems to lie in limited capital, lack of knowledge, lack of imagination, inertia, and misguided economic thinking. In many small plants, funds are lacking even for the simplest automatic devices. Whatever the potential payoff, there always seems to be some other need more acute. In other situations plant management simply does not know what is available, what can be done, has not had the time to sit back and evaluate the developments that have taken place.

Many offer the alibi of low volumes, changing markets, non-repetitive operations. Certainly, transfer machines, custom-built conveyors, automatic loading and unloading devices are too specialized and too expensive for their needs. But examine this further. In the first place, you can buy whatever fits your pocketbook and your needs. If the stakes are high, you pull out all the stops and make the job fully automatic. But there is nothing sacred or necessarily desirable in 100 per cent automation. Circumstances may warrant making the job only 50 per cent or maybe 10 per cent automatic. The cost may not be as great as you think. Ford reports that automatic handling equipment frequently costs less than standard equipment. You need not always sacrifice flexibility for automation. The new Magnadrill, for example, has drill heads which

can be quickly and easily positioned at any angle for cycled multiple drilling. Keller Airfeedrills, which fasten directly to the drill jig, can be readily converted to other jobs. Pneumatic pistons can be switched from one job to another.

General Electric has developed an automatic lathe equipped with "playback" control. As the machinist makes the first piece, his operations are recorded on a magnetic tape. The tape can then automatically direct the movements of that lathe or any number of others so equipped. The Arma Corporation has developed an automatic lathe directed by a punched paper tape similar to a player piano roll. On demonstration, this lathe turned out in 4 minutes a piece which would require a skilled machinist 30 minutes, referring to blueprints, to produce. It took only 15 minutes to punch the tape, and tolerances were held to 0.0003 inches!

Neither of these machines is yet available, and since they are not equipped with turret heads, they are probably limited to fairly simple parts. But the same control principles may some day substitute for cams on automatic machines of all types to make highly versatile yet highly productive equipment. The next step will be to connect these, or automatic machines already available, with automatic handling devices, electronically tie in inspection and assembly, and the automatic factory will be a reality.

Influences Retarding Automation

Some of the hesitancy in automatizing processes and operations comes from a feeling that electronic controls are unreliable and expensive. Past experience has justified that belief. They have been fragile and temperamental. In most cases they must be engineered specifically for the job, and that costs money.

But recognize first that electronic control is not always required. Mechanical means (cams, templates, pneumatic or hydraulic pistons) or electrical devices (thermo-couples, limit switches, relays, solenoids and the like) can often do the job. Our students are developing an almost completely automatic shell-molding machine without using any electronic controls whatsoever. The cost of the control mechanism will be less than $300, yet it will enable one man to run several machines. And this machine will be highly flexible—it is, in fact, being developed for the job shop foundry.

Inertia is another deterrent to automation, especially in a period of easy profits. Still another is business uncertainty. Another is the type of management thinking which keeps equipment operating long after it is technologically obsolete. It is usually easier to obtain funds to keep an old machine running than to purchase a new unit, especially if the old machine still runs well and shows a substantial undepreciated value on the books. But it must be evident, to anyone who will exercise the most elemental logic, that book value is in no way relevant to the question of whether or not a machine should be replaced.

Obsolescence is the result of technological change, and is not affected by accounting procedures. Whether the machine is one year or twenty years old, the question of whether or not it should be replaced with a better machine depends entirely upon comparative performance in the future, not upon bookkeeping entries of the past. As a rule of thumb, Ford assumes that automation tooling is justified if it will increase production and if its probable cost will not exceed $3,000 per man transferred. The figure is very low to insure a write-off within the model year. Most plants are satisfied with a payoff within 3-5 years. The intangibles and unpredictables usually make for a much faster write-off.

Labour groups have in many plants retarded technological progress by insistence on former piece rates, prohibitions on the assignment of workers to more than one machine and outright obstructionism. At the same time, the increased cost of labour is without question one of the greatest incentives to increased automation, and the higher labour forces wages the more the likelihood of replacement.

High income taxes and unrealistically low depreciation rates have also retarded plant improvement. Management often asks "Why invite labour trouble and sink more capital when the government takes away in taxes most of the benefits from improved efficiency?" It should be added that with taxes currently at an all-time high, plant investment is also at an all-time high.

Wider Application Foreseen

What is the future of the automatic plant? One tries to be logical and realistic in appraising the prospects, tries to avoid the temptation to overrate the possibilities. And like being a poor lawyer, it is far easier to be a poor engineer, easier to find reasons why it cannot be done, rather than ways in which it can be done. But there is danger in being too logical. The famous individual who resigned his position in the U.S. Patent Office because there was nothing left to invent was attempting to be logical.

In looking around at western plants, we see many where the volume, the type of product or the lack of finances make automation of any magnitude almost impossible. On the other hand, when as consumers, we look at the articles we buy, many of them (such as pens, pins, pencils, lamp bulbs, cigarettes, bottles, nails, paints) already produced by virtually automatic processes and others (hardware, clothing, toys, plumbing fixtures, plastic products, radios and television) which could be automatized, we lose any fears of overstating the possibilities.

Certainly, there will be many plants which will never enjoy extensive automation. There will be many products which will, for purely economic reasons or by customer demand, continue to be made by non-automatic methods. Yet every plant will have some degree of automation, and it cannot be doubted that the vast majority of the things we eat and use and wear will be made in plants where the only workers will be technicians, not producers. These will not always be products as we know them today, for automation very often requires new materials and complete product redesign.

For Offices, Shops, Travel, Farms

In assessing the prospects for automation, we must stretch our thinking far beyond manufacturing alone. The punched card, which may some day run our machine tools, had its beginning and greatest development in the clerical field. It has recently been predicted that electronic brains will "keep business accounts, run continuous sales records, compute and send out bills, handle entire payrolls, keep running inventories, fix production schedules, serve as vast filing systems, and chart corporate expansion", all without human aid. In retailing there is no reason why electronic circuits could not automatically record each sale, then check credit, bill the customer, post the new stock balance, reorder if necessary, and give management a continuous and up-to-the-second accounting of all operations.

With increased air traffic congestion and travel at supersonic speeds, the shortcomings of human control become critical. Automatic

electronic controls are not subject to such shortcomings, and it is reasonable to believe that they may some day take over full control of aircraft in flight. The same may be true of rail, ocean and other transportation. Computers are already used to handle plane reservations in large centres. And think of the possibilities in accounting, statistical, securities, research and engineering organizations!

The possibilities in agriculture are tremendous. Early this year a Senate subcommittee estimated "conservatively" that chemicals alone would displace more than 1.5 million farm workers in the next 10 years, and almost 3.5 million (or a third of our farm jobs) over the next 20 years. Chemical weed killers can do in 12 minutes what it would require 20 hours to do with a hoe. Chemicals can prevent premature shedding in fruit trees and increase yield. Others can induce shedding and replace hand thinning.

Chemicals can destroy the foliage to hasten ripening and facilitate machine or hand picking. Fungicides, growth hormones, and soil conditioners will help increase crops. Most cotton is already picked by machine. One of our western electronic companies is currently testing an electronic crop thinner, which automatically detects and removes unwanted plants, four rows at a time. The experiments conducted by the Bureau of Mines in burning unmined coal underground in its natural seams may lead to another form of automation.

The Second Industrial Revolution

What will be the impact of automation on our society, our economy, our way of life? In the first place, automation should be recognized as a gradual and progressive development, an extension of changes which have been underway for over 150 years. Furthermore, there are whole segments of commerce and industry which will see only a limited application. This is not to minimize its importance. Historians may well point to automation as the heart of the second industrial revolution. In the first industrial revolution machines replaced man's muscle in plant operations. In the second, control devices will replace his brain. There will be an accelerated use in the near future but there is no reason to think that widespread automation will come overnight.

Commonly associated with technological development is the fear of unemployment. But *Factory* magazine points out that if we are to continue to increase our standard of living and to support the current defense program, we will have to increase output per man hour 43 per cent by 1960, or over twice the increase which took place between 1940 and 1950. This hardly bespeaks widespread unemployment! If medical science continues to make advances in combatting the diseases of old age comparable to those made against infection, communicable diseases and the like, the support of the non-working elderly population will in itself demand a large portion of our increased productivity.

Add to this the defense program, the increased proportion of children bursting the seams of our school system today, and the demands of other nations whose aid we have undertaken, and there seems more reason to fear a shortage than a surplus of workers. Barring a serious depression, there should be adequate opportunity for reabsorption of displaced workers. Technology has *always* created more job opportunities than it has destroyed. A much higher standard of living and a shorter work week are both likely when and if automation reaches its full potential.

The Displaced Worker

In the past, technology has tended to degrade the worker. The turret lathe and the automatic screw machine, for example, replaced skilled journeymen lathe operators with relatively unskilled machine tenders. The war brought about an even greater simplification of jobs and decrease in job skills. Norbert Weiner has written, "It is a degradation to a human being to chain him to an oar and use him as a source of power; but it is an almost equal degradation to assign him purely repetitive tasks in a factory which demand less than a millionth of his brain power."

Will further automation reverse this trend? Gwilym Price is reported to have said at the Corning Seminar on "Living in Industrial Civilization," that "unskilled work is a mistake in engineering." It is the unskilled job which is most easily automatized. Thus automation may in itself eliminate some of the evils and correct some of the mistakes, of mechanization, may replace large numbers of unskilled and semi-skilled workers with a relatively few highly trained technicians, whose function it will be to keep these fabulous and expensive machines operating.

But what happens to those who are displaced, those who have neither the aptitudes nor training to be technicians? In past years the expanding economy which technology created has *always* absorbed those who were displaced. But this was during periods of decreasing skill requirements. Henry Ford is reputed to have said that a whole stratum of humanity was unfit for anything but repetitive assembly-line work. Psychologists dispute this, arguing that such workers are the product of the modern factory, not a justification for monotonous, repetitive assignments.

Perhaps the answer lies in the fact that we will always have many semi-automatic and non-automatic plants which will employ large numbers of unskilled and semi-skilled workers on routine jobs. If the benefits of automation are passed on to the worker and the consumer, the result will be increased leisure and an increased proportion of the national income available for luxury spending. Thus will be created new job opportunities in these non-automatic industries. This in turn raises the challenging question of whether we have the intelligence, the competence to use our added leisure constructively. Greatly increased travel would be one possibility.

More Technicians Needed

Perhaps the other side of the problem is more serious. Shall we be able to find the skilled technicians to supervise, service, tool, and maintain this highly complex equipment, and to adapt it to changing product demands? We already have a severe shortage of technical skills. But we have not yet utilized all the aptitudes already available to us. Industry has much to learn from recent experience of the military in both aptitude testing and mass training to high technical skills. We have much to learn also on creating the incentives which will induce the worker to develop higher skills, incentives which have largely disappeared with the reduction of wage differentials and current high earnings of unskilled workers.

Techniques of personnel administration must necessarily change with the changing character of the employees. These technicians will be freed from the anonymity and monotony of the production line. They will see clearly their part in the operation of the plant, they will be intelligent, competent and will insist on being treated as such.

The demand for engineers to design these complex plants, to keep them operating smoothly, to supervise and control the technicians, to direct shifts to other products, will be great. Operating and design problems will cut across several professional fields—industrial, electronic, instrumentation, mechanical—so a "team" approach will be needed. These engineers must be trained to exercise a high degree of competent and intuitive judgment.

The stakes will be high and they will often be forced to make crucial decisions without delay or assistance from higher levels. There will be little time for the orderly, studied, analytical, leisurely approach of the laboratory. This may call for a new emphasis in engineering education. The selection, organization, and coordination of these specialist engineers and plant technicians may well be one of management's most important functions.

Emphasis on High Utilization

Preventive maintenance will be a must. The automatic factory will be a closely integrated unit from incoming raw material to finished product, and vulnerable at any point. Emphasis will be on high utilization, with little down time available for maintenance activities. Administrative breakdowns, such as materials shortages or faulty planning, will be as serious as mechanical breakdown, and an added premium will be placed on management competence, upon precise planning, scheduling, and follow-up. Relations with suppliers will take on added importance.

Plant location will no longer be dependent upon availability of labor. A guaranteed and stable market for the product will be essential. In most cases, the breakeven point will be high, and cutbacks will be costly. Workers can be laid off, control mechanisms and overhead cannot. At the same time, production increases will be difficult. Since fixed costs will be high the automatic factory will operate 24 hours a day. Expansion of production will be impossible for a plant which is already working around the clock. This lack of flexibility and emphasis on full utilization indicates a need for better than usual sales effort, directed first of all to an accurate determination of the market potential before the plant is built, and secondly to a steady sale of the product.

How well this requirement can be met will determine the future of the automatic factory in many industries. It may also indicate the answer as to whether or not automatic factories will aggravate the fluctuations of our economy. Cutbacks will be much more costly to the owners. On the other hand, they will be less likely to start a chain reaction of reduced purchasing power, for there will be few workers to be laid off. At any rate, the automatic factory offers as great a challenge to sales management as it does to the engineers and to production managers. It is, in fact, one of the great challenges to management of our time.

Scope Greatest in Undeveloped Areas

It is suggested that we in the West —and it is believed the same may be true throughout most of Canada —have the greatest challenge and the greatest opportunity. For although we have less mass production than the industrialized East, we are growing, and we are less inhibited by sunk costs, by existing methods and by vested management or labor interests.

The automatic factory has a tremendous potential for increasing our own standard of living and that of much of the world. It can shorten our work week and increase our leisure. It can release us from dreary, monotonous, unsatisfying repetitive jobs. It can help protect us against those abroad who would undermine our economy. Let us hope that we are big enough to take advantage of this opportunity. It behooves every one of us—engineers, management, sociologists, economists—to read and think and discuss the subject at every opportunity. Thus we can forsee and avoid the pitfalls, minimize the mistakes and dislocations, and make an economic and social asset, not a Frankenstein, of the push-button factory.

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Suggested Classification of Muskeg for the Engineer

by

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

Foreword

The Associate Committee on Soil and Snow Mechanics of the National Research Council has been concerned, since the start of its work, with studies of the terrain of Canada. Muskeg constitutes a large proportion of the total area of the country, although situated in the less accessible areas, its significance is not always appreciated by the city dwellers.

As the boundaries of national development steadily advance, the problems which muskeg can create when it is traversed, or when it interferes with engineering work, are becoming increasingly important. The Associate Committee is therefore pleased to be able to publish this first major report on a project which it has supported financially, and in which it has long been interested.

After an early investigation of the chaotic use of even the word "muskeg" in Canada, the Committee was glad to find in Dr. Radforth a scientist whose special field of interest was palaeobotany, through which discipline an approach to the scientific study of organic terrain alone seemed possible.

Working closely with the Defence Research Board, which is primarily interested in the interpretation of muskeg conditions from the air, the Committee has supported Dr. Radforth in field work at Churchill, Manitoba, in visits to European muskeg areas, and in his laboratory investigations at Hamilton, Ontario, at McMaster University, and the Royal Botanical Gardens.

Dr. Radforth has accumulated a vast amount of information, many samples of muskeg and an unusual library of photographs of organic terrain. Using this, and his wide field experience, he has managed to develop a rational system of classification for a material long regarded as "unclassifiable".

The suggested classification is admittedly a first approach only to a singularly difficult problem. Its imperfections will be shown only by its use. Its improvement and further development will come only after such field application. The Associate Committee and Dr. Radforth will therefore welcome comments and criticisms and, in particular, reports upon the use of the suggested classification in the field.

R. F. Legget
Chairman, Associate Committee on Soil and Snow Mechanics. National Research Council.

The interpretation of mineral soil aggregates has become a well-established study, and is now being approached from many directions in the scientific and engineering realms. Some branches of the field are relatively new. Their development is just beginning to broaden. The consideration of mechanical problems relating to mineral soils, for instance, is comparatively young.

By comparison with this, however, knowledge concerning the interpretation of organic soils is negligible. No organized reference system for organic soils is in existence. Until it is, the utilization, treatment and adjustment of organic soils for engineering purposes will remain a difficulty.

Under these circumstances, the comparison of results in problems of foundation engineering wherever an organic soil is involved will always be troublesome and at best, inadequate. This is particularly true when the soil medium in question is almost completely organic: the material called "muskeg".

Possibly because of its biological origin, muskeg is an extremely complex material. In degree of complexity, it compares favourably with that of any mineral soil and its variability is likewise well marked. Moreover, in assessing this material for engineering purposes, depth, form and other features that refer to the soil body as a whole, are just as significant for the organic as for the mineral soil.

Finally, in applying engineering techniques and interpretations, attendant factors such as water and physiographical phenomena are just as important for organic soils as for mineral soils as agents influencing soil character.

In the present study the writer has had in mind the need for adequate portrayal of muskeg features. It is thought, however, that this objective is secondary in importance to the development and presentation of a system whereby intelligent reference can be made to muskeg.

While it is true that this primary objective relates more to the need of the engineer interested in problems of trafficability, construction and foundation engineering, it is hoped that the information will be of use to foresters, geographers, biologists, pedologists, conservationists, and indeed to all those associated in one way or another with muskeg.

The Expression "Muskeg"

The writer has gone to considerable lengths to determine what is intended by the word "muskeg" by those who use the term. The results of the inquiry have been enlightening but bewildering. The range of meaning ascribed to muskeg is so broad that the word has questionable value when used as a precise reference term. Some would include swamp under the heading of "muskeg". Others would differ and claim that it signifies the shore of a boglake. It has been used as synonymous with tundra. It has been employed to designate imponded areas completely covered with vegetation, or the thickly carpeted floor

The author, Dr. Radforth (left) with R. F. Legget, M.E.I.C., chairman of the annual meeting session at which the paper was presented.

of open spruce woodland, and in many instances has been supplied as an acceptable reference term to signify "peat-bed".

When used in any of these ways, no special size limit is specified. Frequently it is applied in describing large areas of land more or less continuous for several thousands of square miles. This is especially so in the case of the Canadian North and Northwest. On the other hand, it may be utilized as referring to small patches of overburden, particularly in the eastern, western and southern parts of Canada and in some parts of the United States.

The flexibility and vagueness of meaning that "muskeg" implies leads to confusion, and provides serious difficulty when practical and intelligent use of the expression is attempted for purposes of discussion and report. This situation is further aggravated when the expression is used to label the field material itself. Because of this difficulty, it is tempting to eliminate "muskeg" as a reference term altogether. To discard it completely, however, would invite other problems.

Though the term is attended by such lack of agreement, it has, none the less, come into frequent use and doubtless will continue to be used. Also, though its meaning is not clear, those who have become accustomed to using it in connection with their work, regard it with some respect. They are content to ascribe to it their own particular set of values, no matter how this might be at variance with the views of others.

Literally interpreted, "muskeg" suggests simply "peat-bog" (Chippewan Indian, maskeg, meaning "grassy bog"). Though this definition is not adequate as it stands, it does furnish a fundamental meaning which can be widely appreciated, and which shows promise of acceptable expansion. Primarily, the idea of organic constitution is inferred. There is also in the literal definition the suggestion that a high percentage of water influences the character of the organic medium.

A third idea which may be inherent in the literal translation is spatial delimitation. This possibility coincides with the suggestion of some, that the term "bog" includes the saturated organic matter held in a more or less saucer-shaped depression, frequently two or three miles in diameter. This view does not support the impression that muskeg may be an extended sheet of organic material, with a depth generally uniform over great distances, in excess of say, twenty miles.

A workable definition of "muskeg" might thus be simply "organic terrain". The possible weakness may, however, be dismissed if it is agreed that the expression relates not only to materials, but also to states or conditions. Certainly, if any translation of "muskeg" is to exclude this proposal it will have to be regarded as inadequate at the outset.

The expression "organic terrain" seems to allow for the inclusion of the base of the organic matter and the top of the underlying mineral soil in considerations relating to "muskeg". It also allows any reference to topographic conditions and ground surface characteristics in general. The designation does not preclude the use of the expression "organic deposit". It does suggest, and in a sense specifies the nature of the deposit. Some organic deposits such as coal, lignite, oil and submerged peat beds would be excluded by the expression.

Organic Terrain Deposits

The kind of organic deposit included in the expression "organic terrain" has widespread distribution. In contemplating the limitation of "organic terrain" as a reference expression, the writer feels that geographic implications are important.

Organic terrain deposits occurring in Europe, Asia and North America all merit study. In Canada organic terrain predominates in areas having horizons separated by as much as a thousand miles. Such country may be found in the Yukon, in Saskatchewan, and Manitoba. Smaller areas, but still significantly large, occur in British Columbia, Ontario, Quebec, New Brunswick, Nova Scotia and Newfoundland.

Organic terrain also occurs in Washington, Oregon, North Dakota, Michigan, New York and the New England States. To a lesser degree it occurs in other regions within the United States. Perhaps the best known geographic regions in which organic terrain occurs are in the British Isles and in northern Europe. The largest continental areas containing deposits comparable with those of Canada are in Siberia.

The great bulk of the deposit, wherever located, arises as an accumulation of vegetable matter. The thickness of the material varies considerably. It may be one to a few inches in depth, or it may be between one and two hundred feet in depth. Whatever the depth, it is still significant as a potential problem, or as a predominant element providing character or limitation for large areas. For any given expanse of this kind of overburden the depth is more often than not variable. Constancy in depth is, however, a condition not uncommon, particularly in the far North.

Organization, The Basis for Classification

Any system of classification presupposes the existence of organization in whatever medium is to be classified. The higher the degree of orderliness in the medium under study, the better will be the chances for recognizing organization, and the more the promise of rendering a classification that will justify the widest acceptance. Whatever the form of classification, if it is to be successful, its procurement depends upon the manifestation of organization.

It is also important to realize that the procedure of revealing organization may depend on reference to natural relationships within the medium being classified, or on the other hand to artificial relationships arbitrarily revealed. It must also be expected that if the material to be classified is highly complex, the classification system ultimately derived may be also complex. It may include not one, but several, sets of classification systems. In cases of this kind, one system may parallel another, or one system may be subsidiary to another.

It would be unfortunate if, in establishing the basis for classification for a medium that has so far evaded interpretation, an attempt were not made to distinguish between identification and classification. In this account, classification will be used to segregate and define *properties* of materials and conditions. Identification will be used in referring to *examples* of materials and conditions. Thus, examples will be regarded as identifiable through classifiable properties. Thus, it seems proper to emphasize that the recognition of classifiable properties within the organic terrain is the fundamental task.

Survey of Conditions for Classification

Having set out the terms of reference for the basis of classification, it now remains to explore the material and conditions which confront the field observer. This exploration involves two realms: that which embraces the hidden or underground aspects, and that which involves surface features lying in full view.

Subsurface Constitution

In any sort of construction problem involving "muskeg", the field observer generally feels that the materials he is dealing with fall into the category of black, unstable muck. This is inadequate if the engineer desires as clear and complete a picture of organic soils as he insists upon for soils derived from a mineral source. It is therefore necessary that the constitution of organic terrain from the aspect of particle size, form and distribution should be studied and incorporated into the main framework of classification.

This will serve to parallel the increasingly important information existing with regard to the particulate constitution of mineral soils. In the latter field, not only is particle size an important factor for the engineer, but *kinds* of particles, their frequency of occurrence and their distribution, are also important. The relationship between one kind of particle and another in the physical, chemical and mechanical sense is also significant. It is not surprising, therefore, that the same point of view should be accepted and utilized with reference to an interpretation of organic terrain.

Size and Disposition of Constituent Particles

Interpretation of organic terrain depends upon reference to particles or units of two orders of size; one microscopic, the other observable with the naked eye (macroscopic) in the field. The attention of the reader is first directed to the latter.

On the assumption that the field engineer makes adequate preliminary investigation of the organic terrain materials, he will readily appreciate that dead plant remains, appearing as visible units of the terrain, differ widely as to size, quantity and spatial relationships. At one place in the organic blanket he is traversing, he may encounter "black muck" which, when dry, does not fall away but remains in "chunks" or "cakes". These have a fine granular texture, with larger units in negligible abundance.

Instead of this condition he may come across one in which the sample consists of non-woody (soft, resistant) fibres, short and interlacing to form a mesh. Or he may have selected instead a sample in which the fibres (again non-woody and quite numerous) are long, perhaps up to a foot in length, contrasting with an inch or two for the previous sample. These may be ribbon-like and oriented more or less in a vertical plane.

Or he may discover an example consisting mostly of woody, interlacing and thread-like fibres, forming a mat which offers considerable mechanical strength. These threads may be only a few inches in length, but could be several feet long and follow a tortuous course, conforming to no particular plane. The survey may reveal the possibility of the presence of examples in which the fibres are recognizable as tree roots or branch systems, which make it difficult to procure samples.

In some instances, this woody mesh may be made up of short "chunks", in others of extended "pole-like" units of different lengths. It is not the purpose of this article to discuss isolated mechanical properties or sets thereof which these various examples might furnish. It does, however, seem desirable to emphasize the structural contrast that exists between say, the first and last mentioned examples. Mechanical problems relative to these would also show obvious contrast.

Much could be written about variation in quantity of given particle types occurring within a unit volume of terrain. Shape, as well as size and content of the units, would figure prominently. Suffice it to state here that quantitive range with respect to frequency of given particle type must include levels near 0 per cent, as well as levels close to 100 per cent.

It is well to remember that before the observer there is a range of possible unit sizes which includes both particles of granular size just visible to the naked eye, and units which may be the size of fence posts or even larger. Regardless of orientation it is a natural assumption that some sort of three-dimensional mesh, net or web, will inevitably be present in the organic terrain. The interstices of the mesh may be very small or may be quite large, depending upon the size of the units making up the mesh.

Particularly where the interstices are large, it is not difficult to conceive that a mesh of a second order of size may exist in the interstices of the first order. Where the interstices are extremely small their contents are made up of particles microscopic in size, along with various organic derivatives which together form a material essentially colloidal in nature.

Cohesion and compactability of examples will obviously show up differently, depending upon the nature of the mesh, the size of the particles and the constitution of the interstices. Disintegration and tendency to flow or shift or shear, or to resist compressional forces, are other features that will vary with

the physical characteristics of the materials expressed, and depending, too, on their orientation.

Spatial relationships suggest a consideration of the vertical dimension or depth of the organic terrain. The question may arise for instance, as to whether there is a change in range of particle size throughout the depth. This is frequently the case, and the situation may be readily revealed by exposing a profile through the organic blanket. It is important to recognize that this change is, in most cases an orderly one, conducive not only to inspection for quality, but also to measurement.

Where there is change in range of particle size and size of mesh there is noticeable change in the banding or layering that exists in the peaty material. The banding conforms or corresponds with the structural change, making structural correlations and comparisons possible in a given profile or volume of terrain. There are frequent examples, of course, in which the particulate constitution of the organic material is the same for all practical purposes throughout the depth of a section.

Finally, reference should be made to the horizontal dimensions which implies coverage over area. Where the peaty material is uniform in texture throughout its depth, examples are known of its covering areas four or five miles in extent. The deposit as a whole may have a shape which relates to physiographical characteristics of the area in question.

Shapes of deposits more often than not conform to recognizable features or conditions prevalent either in the landscape, or through the nature of the organic material under observation. Where the construction of the material is not the same throughout its depth, but is noticeably banded as revealed in profile, the frequency of change in peat construction over an area is comparatively high.

It can now be seen that reference to organic terrain on the basis of particle size and distribution cannot be considered adequate if use of expressions such as "black muck" are insisted upon. Intelligent appraisal of conditions existing in organic terrain will never be possible, as long as it is thought only necessary to refer to peaty material as constituted of leaves, twigs and other plant remains.

Water Content and Drainage

There must be acknowledgement of the presence of water either in liquid or solid form in relation to a survey of conditions for classification. The peaty material in the organic terrain forms a natural reservoir for water, and conditions are known where drainage is almost impossible. Regardless of particle size, shape and arrangement, the constitution of peat is such that it can retain large volumes of water. It can be shown that like volumes of peaty material differing in physical make-up will drain at different rates, will recharge at different rates and will have different potentialities for maximum water retention.

Structure and amount of organic terrain are also related to natural drainage channels, some of which are obvious to the eye because they exist as river-like systems; others of which are not so obvious, in that they travel within the peat or at the peat-mineral interface, and can only be recognized through imponding.

Before drainage in relation to organic terrain can be adequately assessed, seasonal climatic data have to be related to local field and organic terrain conditions. Enough has been surveyed to establish the claim that water content is not merely related to organic terrain. It enters into its constitution, and must be regarded as a part of "muskeg", along with the peaty material. Thus, water (liquid or solid) enters into the definition of organic terrain, and definitions are fundamental to classification.

Organic-inorganic Interface

In consideration of mineral soils, it often occurs that the engineer must direct his attention to regions within a soil body, where a soil identified as having one set of properties is related physically to a soil identified as having another set of properties. This region of interrelationship is often more important than either of the two parent bodies concerned in the relationship.

Sometimes the zone of contact is very narrow and mainly in one plane. Sometimes there are faults in it, and other structural deformities. Occasionally it may be a zone of some depth—a kind of transition bed which may vary in thickness throughout the zone. In the case of each of the parent bodies referred to, it must be recognized that the attributes of each include a consideration of the fact that the one soil body has the other as its neighbour.

A similar situation arises with reference to the peaty layer of the organic deposit and the mineral soil sub-layer in contact with it. The zone of contact is often quite thin and sharply marked. On the other hand, the writer has worked with an interface material which was mineral matter highly charged with organic material nearly a foot in depth, forming an interbed which varied in thickness and in structural composition.

It is not always the case, as is commonly supposed, that the mineral substrate is fine textured, falling into the category of silts and clays. On the contrary, organic overburden often lies directly upon a coarse grained substrate of a sandy, sometimes gravelly constitution. Indeed, it is not infrequent to find that the peaty layer may be in contact with coarse gravels containing quite large boulders. If the organic layer is only a foot or two in depth, the contour of the boulders or rocky outcrops is imparted to the peaty overburden, and becomes a topographic feature of the organic terrain.

Examination of the zone of interface often reveals wide differences as to relative amounts of water. Sometimes the interface is almost completely fluid. On the other hand, it may be just moist. Water by reason of its presence and abundance is an important component of the interface zone.

Interface problems may be just as great as those involved within the organic layer itself. This is not to suggest, however, that in specific problems, as for instance with highway subsidence involving failure of foundation materials, it is necessarily the interface that must be held responsible. Where a whole roadbed slides to one side, possibly the worst kind of failure found in "muskeg" country, studies suggest that failure is more often a function of structural relationships within the organic layers, which have not been accounted for in surveys that preceded construction.

Emphasis, so far, has been placed on sub-surface constitution. Composition of organic material, water relations and organic-inorganic interface have each been referred to separately. The ultimate system of classification may reveal a relationship linking the three subtopics. Even at this stage of "muskeg" interpretation, prediction of the constitution of the mineral sublayer is not ruled out once the constitution and extent of the organic layer has been determined.

Surface Coverage

For foundation, drainage, construction and trafficability prob-

lems, those concerned usually give first consideration to the soil body. With mineral soils, examination of exposures and interpretations from borings are always useful. The same should apply with organic soils. Profile exposures are none too frequent in this case, however, and while borings are always possible, the presence of other field marks can prove useful. In the latter connection, an observer traversing organic terrain is tempted to make use of the upper level of the organic layer. This comprises the aerial and subaerial parts of all the living plants affording coverage for the dead organic material in the rest of the organic overburden.

The Living Organic Layer

For purposes of this survey of conditions for classification, the most important matter is to emphasize that the living organic material is an essential part of the organic terrain. It is certainly included in the literal translation of "muskeg" referred to earlier. Recognition of this means a corresponding extension of the list of properties which have to be used to describe organic terrain.

The field investigator has the responsibility of recording field conditions, as he experiences them in studying organic terrain. He is always alert to the possibility of finding plant types which he may use as valid indicators for various purposes. More often than not, he attempts to find the common name for any plant which he may select. The writer is quite certain that this idea was not initiated by botanists, but by field workers of other professions, trades and vocations.

In an attempt to confirm the validity of this procedure and its degree of usefulness, the writer, particularly in his work in the Churchill area, made a fairly complete collection of plants typical of the organic terrain of those regions. Most of the striking, colourful types of plants have, however, proved troublesome when used as indicators. Perhaps this is partly because certain plant types of the nature referred to are not faithful as indicators for given terrain conditions.

This, however, does not eliminate plants of the living organic layer as analytical indices. Independent field investigators and observers have developed habits of referring to particular kinds of vegetative coverage. Though non-botanists, they apparently had little difficulty in establishing common denominators on which they could compare their experiences, by reference to vegetation properties for which they provided their own descriptive terms. In discussions bearing on these matters such terms as trees, shrubs grasses and mosses would be used. Such reference methods are not new to engineering surveyors, as shown by old survey records. With crude reference terms where precise designations are required, the advice of a trained field botanist is always of value. These preliminary attempts at coverage recognition provide encouragement for the botanist (field ecologist).

The Topographic Factor

In its broadest meaning, topography suggests description of form outline of land areas. Physical features, relating to unevenness of contour, take a prominent position in terrain consideration. In practice, location of drainage basins is also important, but in organic terrain appraisals, expediency rules that attention be given to terrain unevenness. Where water bodies are concerned, the nature and stability of the organic foundation lining the water course must be observed, both beneath the water and at the banks. Whatever the point of view of the field surveyor responsible for the interpretation of field conditions, he is bound to concern himself with over-all form and form trends, if any, as he attempts to traverse organic terrain.

It has been suggested that topographic difference in organic overburden is sometimes due to irregularities in the mineral foundation of the organic blanket. On the other hand, much of the unevenness seen from the surface is due to topographic change within the organic material itself. In studies of mineral soils it is not always easy to demonstrate the reason for topographic change. The same difficulty arises for the organic soils. In the north, frost phenomena are prevalent, and these are the controlling agents in contour establishment and regulation. Other agents are water and wind.

There is evidence that these factors sometimes act together to produce some of the shapes of the organic terrain. Perhaps the most influential agent, however, is one that is a function of the vegetation (dead and living) which forms the organic overburden. This is recognized partly through change in character of the peaty material, and partly through growth habits of certain plants as they augment and accumulate organic debris at their growth sites.

Even if contour phenomena were eliminated as necessities in "muskeg" interpretation, field appraisers and those whose task it is to deal with "muskeg" would be among the first to insist that methods be devised to account for them, to assist in classification and in intelligent appraisal. Coverage and topography are important also in aerial interpretation of organic terrain. But whether the observer is in the air or on the ground, coverage and topography are the conspicuous factors of the organic blanket on which he is primarily dependent.

The Seasonal Aspect

An appraisal of the conditions for classification of organic terrain is not complete without reference to the time factor, as this associates itself through seasonal aspects. In most parts of Canada, "muskeg" is completely frozen throughout the winter. Possible exceptions to this may arise due to the lower depths of very deep deposits being protected from frost for at least a part of the winter by the insulating values of the upper layers of the deposit.

With the approach of high temperature conditions in the far north in later spring and early summer, melting of the active ice commences on and within the organic mass. Due chiefly to drainage lag, for which the peaty materials are partly responsible, the accumulation of water is very marked. This is notably true when rainfall in the early summer is high. If, on the other hand, rainfall is not excessive, and if winds are frequent and strong, excess water and the growth of ponds may not be too noticeable, as compared with average conditions.

The wasting of the active frost layer during the summer months is a slow process. This applies, of course, chiefly in the far north as for example, around Churchill and towards Le Pas in the south. The condition has its effect on the appearance of the coverage, imparting to it seasonal aspects which are characteristic for each time period during summer and early autumn months. The seasonal aspect will vary depending upon coverage and other properties of the organic deposit. Mechanical properties of the various kinds of peaty materials will also show relationship to this seasonal factor.

In field inspection, it is difficult to resolve the seasonal factor into something tangible which can be evaluated in terms other than qualitative. Some assistance is, however, afforded through the medium

of colour. With the advance of season there are local and general background colour changes in the coverage. Though the task is not easy, it is possible to measure and record colour response in superficial segments of the coverage, as well as in background coverage. This is done with the aid of the Munsell Colour System.*

*Munsell Book of Color: Pocket Edition, Munsell Color Co. Inc., 1929-1942.

The Classification System

It is now possible, against the foregoing background, to suggest the main lines of the classification system so far developed to meet the need for accurate identification of muskeg. This is a first presentation only, given in summary form on the basis of work extending throughout five field seasons and winter laboratory working periods.

Coverage Pattern and Typing

Classification depends upon the possibility of revealing organization and relationship. If this can be done, a major first step will have been accomplished. The only other fundamental prerequisite to classification is to plan for a level of adequacy appropriate to the degree of complexity of the materials and conditions being classified. For organic terrain, with its high degree of complexity, several subsidiary systems are required.

One of these systems should be based on coverage. For the purposes of this account, priority should be given to it, in that it is the first factor of the terrain which the observer notices when he encounters a "muskeg" expanse. If coverage classification is to be in terms of a subsidiary system, it would be of little value if its relationship to another subsidiary system dealing with another main factor of the terrain were not anticipated.

In segregating coverage character, therefore, the plan has been devised in accordance with the following rules:—

(1) Only those features of coverage most likely to show direct relationship with features of the dead organic material comprising the bulk of the "muskeg" deposit, will be utilized.
(2) The expressions used in classification will be those best suited to the recognition of organization in the coverage;
(3) The expressions and the level of organization ultimately depicted will be such that they can be used also for aerial inspection and interpretation. Travel over "muskeg" is predominantly by air.
(4) The terms employed will be such that they can be readily understood and utilized by non-botanists; and
(5) Types of coverage that the terms express must be photographed, and authentic photographs must be available for wide use.

As may well be expected, meeting the challenge of this grouping called for much checking and rechecking from the air and from the ground, both in field observation and in laboratory analysis of results. An added complication arose through the need for anticipating trafficability problems and mechanical problems in general, sometimes relating to industrial, sometimes to engineering and sometimes to agricultural, geological, forestry or military requirements.

The accompanying table (Table I) presents the descriptive information for nine coverage class types. Photographs depicting these types appear in Figs. 8-16. An examination of the schedule given in the table will show that the properties mentioned are not referable to species of plants. They relate instead to qualities of vegetation. These are principally stature, degree of woodiness, external texture and certain growth habits easily recognized by an inexperienced observer, especially with the help of photographs. Examples of plant material are given following each colour-type description.

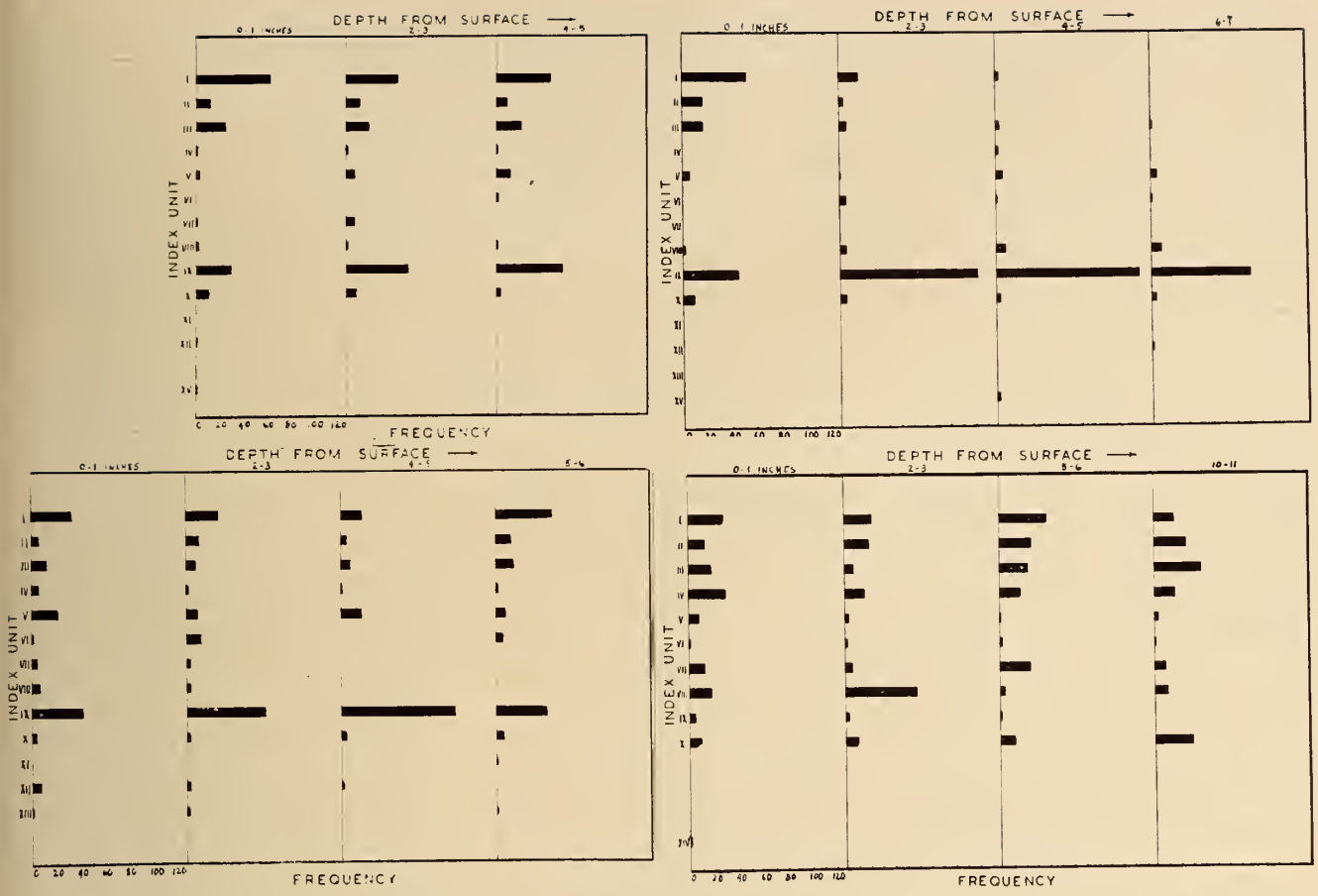
Commenting briefly on method of application, it is important to note in the first place that, when an observer records an appropriate class designation by letter, that letter by reason of its relationships in the table signifies the properties suggested. Seldom do these properties defining the coverage exist alone. They occur rather in combination with properties for which other class letters are symbolic. In other words, one seldom finds pure classes existing by themselves.

For given areas requiring analysis, practice seems to decree that, if one set of coverage class properties is not present to the extent of twenty-five per cent, it lacks enough prestige to give it significant prominence in the composite cover description. The complete description may sometimes, therefore, be given, though not often, in terms of one, two or three letters.

The reader might expect an overwhelming number of combinations of classes. For selected areas in the Churchill region and far to the south, however, this is not the case. For instance, the descriptions involving the use of the letters F - E - I are quite frequent. In the formula, or combinations of letters,

Table I—Summary of Properties Designating Nine Pure Coverage Classes

Coverage Type (Class)	Woodiness vs. Non-woodiness	Stature (approx. height)	Texture (where required)	Growth Habit	Example
A	woody	15 ft. or over	—	tree form	Spruce Larch
B	woody	5 to 15 ft.	—	young or dwarfed tree or bush	Spruce Larch Willow Birch
C	non-woody	2 to 5 ft.	—	tall grass-like	Grasses
D	woody	2 to 5 ft.	—	tall shrub or very dwarfed tree	Willow Birch Labrador tea
E	woody	0 to 2 ft.	—	low shrub	Blueberry Laurel
F	non-woody	0 to 2 ft.	—	mats, clumps or patches, sometimes touching	Sedges Grasses
G	non-woody	0 to 2 ft.	—	singly or loose association	Orchid Pitcher plant
H	non-woody	0 to 4 in.	leathery to crisp	mostly continuous mats	Lichens
I	non-woody	0 to 4 in.	soft or velvety	often continuous mats, sometimes in hummocks	Mosses



Top left to lower right: Fig. 1, Fig. 2, Fig. 3, Fig. 4.

that letter which represents the most prominent set of properties is placed first. If other letters are involved, they follow in the formula in order of prominence.

Thus, the formula gives a description of coverage composition in terms of properties and lays emphasis on the set of values most typical for the area. It is instructive to select at random areas of, say, ten square miles in extent and to analyse them by application of the methods suggested. Within a given area so selected, the frequency and degree of influence that each set of class properties shows is easily derived from the sets of formulae obtained. The formula having greatest frequency will also be revealed.

Finally, if the formulae are mapped, directional trends are exhibited. If several areas are compared with reference to properties, the degree of importance with reference to these factors can be derived, and the pattern exhibiting coverage properties becomes manifest. In short, coverage organization is revealed.

Referring again to the guiding principles, there is good reason to suggest that points 2 to 5 have been satisfied. The aspect of aerial interpretation is being tested on the basis of the method prescribed here, and evidence has been suggested to show that it can be applied satisfactorily. Improvements and adjustments of a secondary nature will doubtless be forthcoming, but fundamentally, main requirements are met. Discussion concerning the application of the method and system in relation to rule (1) will be left to follow the discussion of the next subsidiary system.

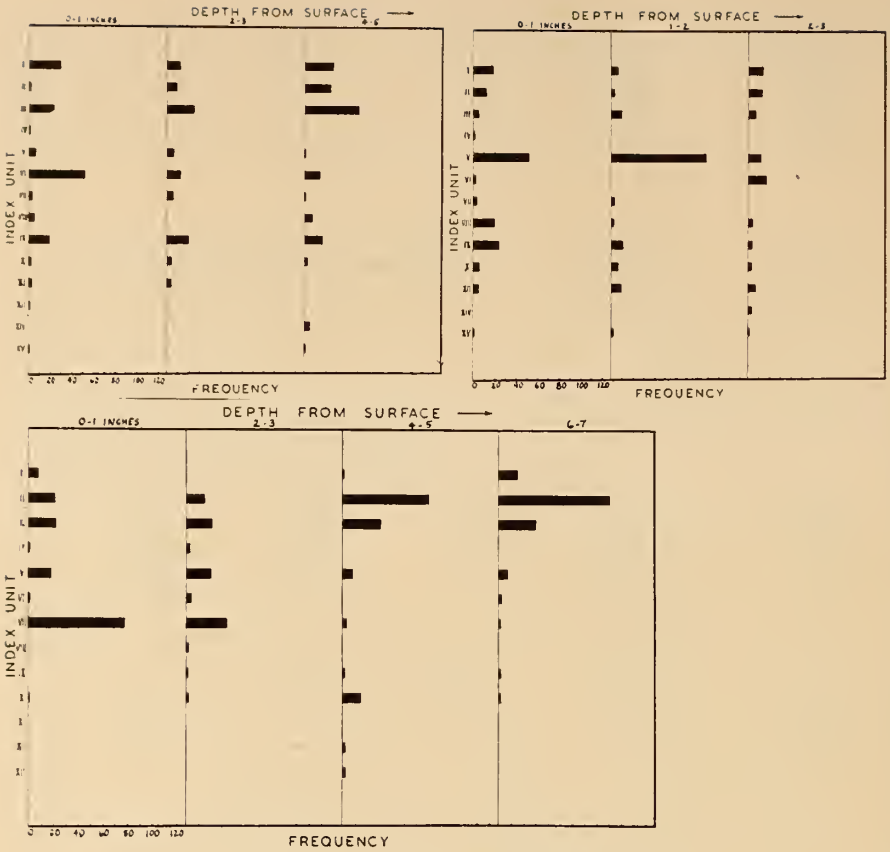
Indexing for Subsurface Character

Turning now to the dead organic material in the organic terrain, a different approach is needed to derive a workable classification system. In making the survey of the materials available to which classification is to be prescribed, reference has been made so far to macroscopic features only. Attention of the reader has been called to information suggesting the presence of a mesh structure and related interstices. There is some evidence suggesting that differentiation of peat samples might be accomplished through an understanding of mesh size, construction and prevalence.

This alone is not enough, because during the formation of the organic body the mesh characters might well remain relatively constant, particularly with the larger sizes of mesh, while characters of the peaty material might change. The nature of a secondary mesh, for instance, could easily change in constitution without noticeable change in the structural relationships of the primary mesh. The material in the interstices might also change with time, in amounts sufficient to alter the physical properties of the peaty deposit as a whole.

Consequently, if some method of classification could be devised to give a record of the succession of vegetation, built into the deposit as a whole in the course of time, this would provide a more certain basis. It would also permit a better understanding of the macroscopic ingredients from the point of view of both classification of properties and the appreciation of mechanical problems.

To accomplish this task, it is necessary to look to a study of microscopic constituents. As the components of past vegetation matured and contributed their remains to peat formation, their presence was recorded by the numerous pollen grains, which are normally preserved as they fall into the peat. Many of these are doubtless carried some distance before they alight. It is, however, a reasonable



Top left to right: Fig. 5, Fig. 6. Lower: Fig. 7.

assumption that large numbers, if not the majority, fall in the area where they are produced and provide a continuous record of the vegetation.

Should it occur that, during this recording, climatic conditions at intervals are such that the surface of the deposit is dessicated, preservation would be interrupted and the continuity of the record broken. This, however, is not a serious matter if these fragments (microfossils) are to be used to symbolize that vegetation which had been preserved, and whose record had not been destroyed by climatological conditions. It is only the existing portion of the deposit that is before the observer for interpretation. It is to these microfossils that the writer turned for help in classification problems relative to sub-surface conditions.

In the initial part of the investigations there was much hesitancy concerning this approach. This was partly because much of the field work was being carried out in the north, sometimes at latitudes further north than Fort Churchill, Manitoba.

Most of the work done in connection with microfossils has, however, been related to forest history and the study of past climates. For this the chief kind of microfossil utilized is that derived from tree pollens, and in the north there are vast areas which are treeless. For the present work the kind of microfossil which would carry most influence would be that which has been produced by plants growing on the site under examination. The question arose whether there were enough of these relicts throughout the peaty deposit to provide material that would stand statistical analysis. It took two summers to convince the writer that this was a reasonable possibility, and detailed analyses were then pursued on a broad and intensive scale.

This approach for recent organic deposits is entirely new, particularly when it is associated with the idea of revealing properties for classification purposes. It is not new, however, applied to coal structure, stratigraphy, and utilization problems. The difficulty of readapting techniques of analysis and providing new ones caused some complications. Planning and carrying out the field work on a sufficiently broad scale was time-consuming.

The materials studied for microfossils were obtained from the field, either as cylindrical cores taken with a peat borer (Hiller Model), or as channel samples from an exposed peat profile. The ultimate analyses were made from portions one cubic inch in size, removed at intervals from different levels of each core. Usually every second inch was examined. The microfossils were released from the rest of the peaty matrix with the use of chemical reagents (ten per cent potassium hydroxide is most frequently used by palaeobotanists for this purpose). Following washing and centrifuging, a few drops of the sediment were transferred to microscope slides for permanent record.

It was from each of these sets of preparations that microfossil identifications and counts were made. For this, the usual practice adopted by palaeobotanists is to count two hundred microfossils with the aid of a microscope fitted with a mechanical stage, then determine from this the proportion of each kind or category of microfossil. Sometimes the total number counted may be less than two hundred where statistical comparisons seem to warrant it. This was the method adopted for the investigations reported here.

When it was reasonably certain that enough samples had been analysed to reveal a complete range of microfossil types, attention was centred on variation in frequency for each kind of microfossil, at different depths in the peat and in many locations over a wide area.

The fundamental aim was to utilize the microfossils as identifiable reference units, which would point to state, organization, and change, if any, for all manner of peaty profiles and examples which showed even slight structural differences. For the non-botanist, recognition need only be given to the fact that in the process of analysis these microfossils are related to the plants from which they are derived. If this is appreciated, it is then only necessary to call each microfossil category an index unit and to give it a number. The strictly botanical aspects can be dealt with elsewhere.

One more brief point requires explanation before the inspection of results should be made. This has reference to microfossil frequency. Not only is the actual presence of particular microfossils significant; numbers at given levels in the peaty deposit provide data equally, if not more significant, in evaluating results. It must be emphasized also that wherever numbers of index units are mentioned, *relative numbers* are inferred.

Attention may now be directed to Fig. 1. Each of the three sections of the diagram records the occurrence and relative frequency of the microscopic index units for three depth

intervals within a core sample. The core was analysed according to the method described earlier.

There should be no difficulty in understanding the terminology expressed at the co-ordinates of the graph in the figure. Each configuration in successive histograms designates both presence and frequency for an index unit. Because these configurations differ as to length, collectively they provide a histogram pattern useful in classifying the condition with respect to the microfossil features for the appropriate depth. For the three sets of histograms indicated, observe there is close similarity in appearance and therefore in classification value. Examination of the detail within each histogram reveals important information. It is of primary importance to recognize the more general feature, namely that which demonstrates relationship in histogram pattern.

Similarity, in the form of faithful repetition suggests stability in the constitution of the peaty deposit throughout its depth. This is in addition to the more fundamental fact that these methods provide the means for a practical comparison —one which is confirmable and which lends itself to quantitive measurement.

It is encouraging to the investigator, and to all those who desire to interpret organic terrain conditions, to discover that these first data assist in establishing confidence in the matter of classification of the dead organic material, not only in principle, but also at the level of practical necessity.

Referring now to Figs. 2, 3 and 4, similarity in histogram pattern will also be observed. It is true that there are slight differences. These are of a secondary nature, however, and can be rationalized when matters of detail are under consideration. This lends support to the view that the analytical methods have validity, and that a reliable basis for classification is established.

The next significant feature of the results is that for a given set of histograms, the set of patterns is peculiar to that example. For instance, a comparison of Figs. 1 to 4 shows that marked contrast exists among the four examples, in spite of the high degree of similarity in each. Thus peats, stable in constitution throughout their depth, may differ in constitution one from the other. This then is another major and encouraging demonstrable fact revealed through application of these methods. It is further proof of organization, it affords classifiable data, and it refers directly and indirectly to constitutional features utilized as factors in the interpretation of peaty materials in the muskeg. Deliberate attempts have been made to avoid the use of botanical expressions, in order that field reference may be made in terms understandable to all.

There is yet a third general organization feature discernible. For this, reference should be made to Figs. 5, 6, and 7. A comparison of these histogram sets shows:—

(1) Dissimilarity of histogram pattern for each set;
(2) Each set differs in pattern from the others;
(3) Organization still reflected in spite of variation as suggested in points 1 and 2;
(4) Constitutional trends (not stability) which have arisen with growth in depth of the peaty deposit; and
(5) Each item (1 to 4) can be assessed on a quantitative measureable basis.

The data used in these graphs are derived from only seven bore samples from the Churchill area. Hundreds of such samples have now been taken, and many of them examined for index unit relationships. Samples are also available from northern Sweden, the Orkney and Shetland Islands, as well as from several places in Canada. When enough histogram patterns are available for wide comparison, relative prevelance of pattern, and hence relative prevalence for organization trends, may well be discernable.

In the meantime a workable and adaptable system for identifying peats is now available. That it is workable has been demonstrated. That it is adaptable has been only partly demonstrated. In connection with the latter, the question arises, how can the system be utilized in demonstrating organization from the standpoint of structural features, significant from the aspect of mechanical problems? The answer depends in part on a consideration of other subsidiary systems of classification, two of which have not yet been reviewed. One of these which deals with topography will be presented next.

Descriptive Terminology for Topographic Features

In the section dealing with the relationships and importance of the topographic factor to problems of surface coverage classification, an account of the precise terms of classification for topography was omitted, for inclusion under this main chapter on classification. As was the case in selecting type categories for vegetation coverage, and in selecting type index units for subsurface appraisal, so with topography type expressions are necessary. It is important in making the selection that they prescribe to all contour phenomena, that they conform if possible to expressions already in use, and that they be as few in number as circumstances permit.

Table II—Terminology and Properties for Topographic Classification

Contour Type	Formation	
a	Hummock	includes Tussock and Nigger-head, has tufted top, usually vertical sides, occurring in patches, several to numerous.
b	Mound	rounded top, often elliptic or crescent shaped in plane view.
c	Ridge	similar to Mound, but extended, often irregular, and numerous; vegetation often coarser on one side.
d	Rock gravel plain	extensive exposed areas.
e	Gravel bar	eskers and old beaches.
f	Rock enclosure	grouped boulders overgrown with organic deposit.
g	Exposed boulder	visible boulders interrupting organic deposit.
h	Hidden boulder	single boulder overgrown with organic deposit.
i	Peat plateau (even)	usually extensive and involving sudden elevation.
j	Peat plateau (irregular)	often wooded, localized, and much contorted.
k	Closed pond	filled with organic debris, often with living coverage.
l	Open pond	water rises above organic debris.
m	Pond or lake margin (abrupt)	
n	Pond or lake margin (sloped)	
o	Free polygon	forming a rimmed depression.
p	Joined polygon	formed by a system of banked clefts in the organic deposit.

Through field experience it has developed that the accompanying table of expressions is adequate in classifying topographic properties (Table II). Many of the features listed in the table occur, as far as this writer is aware, only in regions north of, say, Le Pas, and more frequently as one proceeds northward. The system is therefore somewhat detailed for prevailing conditions in the south or in northern Europe. All the criteria mentioned are useful, however, especially in aerial inspection and in enhancing applications of the classification system devised for vegetative coverage of the organic terrain. Reference to this aspect will be made later.

Other Physical Phenomena

The importance of drainage in muskeg problems has already been indicated. For purposes of classification, drainage becomes a secondary problem and its features can best be understood by a more thorough knowledge and application of the subsidiary classification systems mentioned in preceding sections. It would seem that this same view still holds, even if we regard the water factor not from the point of view of drainage, but rather from the aspect of presence or absence of water in given terrain examples, both fluid and solid. No subsidiary classification system seems necessary, therefore, to deal with the water factor.

As has been suggested, the water factor is largely a function of seasonal and climatological influence. The latter seems to be secondary from the point of view of classification for organic terrain; the former, though directly pertinent, is highly intangible and difficult. The utilization of colour, however, to display seasonal trends, and visible indices in the terrain is not impracticable. Much is being done to exploit it for classification purposes, as well as for aerial interpretation of organic terrain.

If an attempt is made to assess colour in terms of absolute values rather than range, it will meet with certain failure. When, however, classification is based on range, and is applied to the contrasting vegetation groupings represented in coverage formulae, there is much to be gained. By the application of the Munsell Colour System the seasonal factor in the organic terrain can be intelligently appraised. It is hoped that a future report will be prepared to cover this phase of the work. Pocket editions of the Munsell System are obtainable for field use, and range of colour formulae can be worked out on the spot for various coverages at different times.

Little can be said at this stage about classification with respect to organic and mineral soil interface. Temporary assistance, however, can be attained for this purpose through a discovery of interface conditions wherever sampling is desirable. Reference has already been made to the fact that various kinds of substrates can be expected when exploring at the base of the organic layer, whether this be a few inches or many feet in depth.

Colour in terms of hue, degree of greyness, and intensity in the subject material, along with interface character expressed in qualitative terms, can readily be added to information derived through the application of the other subsidiary systems, to give the over-all picture of the inter-relationship of properties for the organic terrain.

Application of the System and its Potential Value

Whatever the final form may be for a suggested system of classification of "muskeg", it is clear that the integration of several subsidiary systems is required. This idea is directed towards the need for differentiating muskegs, whereas rules of classification normally demand that an adequate definition be given first of the general material to be classified. "Muskeg" has become the term designating organic terrain, the physical condition of which is governed by the structure of the peat it contains, and its related mineral sub-layer, considered in relation to topographic features and the surface vegetation with which the peat co-exists.

The next logical step in "muskeg" classification is to apply the subsidiary systems to given examples of "muskeg". Part of this is best done in the field, as in the case of mineral soils. The remainder can be done in the laboratory, again as is done with mineral soils after appropriate bore samples have been procured and analysed in systematic order. On the record sheet attached to each sample will appear, "coverage description" (Table I). Following this will be the terminology pertinent to topography classification (Table II).

In both of these cases care should be taken to note the position of the sample or samples, relative to the limits of the coverage formula location, and the proximity to topographic change. This factor may be recorded in terms of linear measurement. Third on the list are the Munsell reference formulae appropriate to the position of the sample

Data Sheet I

Sample . . . . Bore 173.
Location . . . Fort Churchill, Manitoba. Area P_5, A run at intersection with B in the airphoto. (Sonne x26, x38, x201, x202, x210).
Date . . . . . 30 August, 1948.

INTERPRETIVE DATA (FIELD)

	Direct Method	Photo Method (Sonne)
Coverage description	H E (Table I)	H E
Topographic classification . . .	i (Table II)	i
Munsell formula	$10.0Y\ \frac{5\text{-}6\text{-}78}{2\text{-}4}$	$2.5Y\ \frac{8}{6\text{-}8}$ $7.5Y\ \frac{8}{8}$
	$2.5GY\ \frac{6\text{-}7\text{-}8}{2\text{-}4}$	$5.0Y\ \frac{8}{6\text{-}8}$
Proximity to topographic change	50 ft. approx.	50 ft. approx.
Field photos	x29 Nos. 13 to 16	

Data Sheet II

INTERPRETIVE DATA (LABORATORY)

Slide Nos. . . . . 1040, 1046, 1127.
Analysis Sheet . . . . . No. 14.
Intervals Examined . . . 0-1″, 1-2″, 2-3″.
Index Units . . . . . Histogram pattern deposited in laboratory Royal Botanical (Occurrence & Frequency) Gardens, Hamilton. (See Fig. 3 and remarks below.)
Macroscopic Features . . . Not sharply banded, fine mesh, granular to non-woody at base changing to: granular to woody fibrous at top resting on sand/gravel base. Near to highly decomposed less stable non-woody fibrous derivative.
Remarks . . . . . Histogram pattern reveals predominance of index unit IX at all depths but decreasing at the surface. Units V and IV and VI are prominent at the surface.

Top row: Fig. 8. Coverage Class A.
Centre row: Fig. 11. Coverage Class D.
Bottom row: Fig. 14. Coverage Class G.

Fig. 9. Coverage Class B.
Fig. 12. Coverage Class E.
Fig. 15. Coverage Class H.

Fig. 10. Coverage Class C.
Fig. 13. Coverage Class F.
Fig. 16. Coverage Class I.

or samples in the field, and based on coverage colour in the region where the samples were taken. Information concerning date and local prevailing climatological conditions should be appended to this record.

This information should then be sent to the laboratory, along with the sample or samples, in order that further data can be added following analysis. This will appear in the form of series of histogram patterns showing index unit relationships. These will be few or several, depending upon the number of bore samples procured and the extent and detail of information desired. Appended to this should be notes concerning the macroscopic or gross structural features of the peaty material, as they appear in the sample or samples. Field notes concerning the proximity of other structural types in neighbouring locations would be useful in the appendix. This would be particularly the case if bore samples were few in number and the area concerned was one which appeared to contain a variety of structural types of organic terrain conditions. An example of a reference sheet accompanying a field sample is shown in the accompanying Data Sheets.

The analysis suggests fine textured wood-fibrous organic matrix will predominate, but will be interrupted at intervals of twenty-five to a hundred feet with discontinuous areas of coarser, mechanically resistant woody matrix. This general type of terrain will thin out in some areas, giving place to relatively low-lying non-woody fibrous peat. The latter kind of matrix will probably be fairly continuous as a common base for all the organic coverage.

Topography will be generally moderately irregular, with abrupt and frequent amplitude of change averaging about a foot. Ponding will not be so great as to render traversability unpractical. The terrain will be moderately well drained. Sub-surface ice contour will be irregular with isolated well covered prominences until towards the end of August. Tree coverage is generally sparse for this kind of peaty coverage.

When the classification picture thus derived is complete, interpretation of the organic terrain conditions is then possible. To those who have not worked with "muskeg" it may seem unfortunate that so much by way of classification data is required. Those who have worked with mineral soils however, will perhaps not be surprised because the degree of complexity involved in this procedure does not exceed that which the mineral soils demand.

In any event, it would appear that with organic soils, this apparently high level of complexity is further reduced through the possible existence of relationship between subsurface and surface conditions in the organic terrain, and which are shown in the classification record.

Thus, where coverage class F predominates for a given set of examples, and index unit IX in the histogram configurations is consistently prominent throughout the depth of the organic matter, it is

highly probable that the macroscopic or visible component of the peat that will predominate is of the fibrous ribbon-like structure, and that this condition will hold for the entire depth of the muskeg at that place.

It is a simple matter to check on this with histogram configurations available, but it is most convenient, especially for those anxious for quick field appraisal methods, to discover that by scanning the coverage and making sure of the appropriate formula, they can assess the structure of that which lies beneath. This would obtain for the situation as represented in Fig. 1. It would also hold for the situation as shown in Fig. 2, and for the same reasons.

It would also apply for the case indicated in Fig. 3, but the situation which brings index units IV, V, VI, into relatively greater prominence would also be reflected in the surface coverage formula. Predominance of woodiness, and greater strength of fibre would be noted in the peaty material—factors which again could have been predicted. Shift in character of histogram pattern as exemplified in Figs. 6 and 7, also relates to surface properties as depicted in coverage formulae.

For the peaty material represented in Fig. 7, fine woody fibrous mesh at the top with coarser and stronger mesh at the base would be expected. The writer believes most of this detail could be predicted from knowledge of the vegetation coverage formula. In this case as with the others, laboratory analysis provides the best means for confirmation, particularly if the knowledge is to be applicable for areas extending a good distance beyond the zone of sampling.

The index unit composition (Fig. 4), suggests a gross structure predominantly non-fibrous, and non-woody, changing near the surface, however, to a slightly fibrous-woody constitution. In order to predict this from surface observations, however, more formulae depicting coverage conditions would have to be secured than usual. Also without laboratory analysis the change in peaty constitution might not be detected. Certainly its extent could not readily be estimated.

For a superficial examination, especially for purposes of aerial interpretation, surface and subsurface relationship holds to a workable and encouraging degree. There is no doubt but that the microfossil analysis on the index unit basis suggests structural character, particularly with regard to occurrence and possible extent of secondary mesh and presence or absence of constitutional stability.

Referring more generally to potential value of the suggested classification system, it should be noted that it is the combined or integrated (master) result, rather than a single subsidiary system, which lends itself to adequate interpretation and possible solving of mechanical problems. Such problems range from trafficability to drainage; from insulation and utilization problems to questions involving possibility of support for forest coverage in developmental and control programs.

The correlating of organic terrain features is most important for Canada. Like subsurface geology, it is a subject which depends upon intelligent prediction. Complete success in this can follow only from proper application of field and laboratory classification records. As these accrue, not only will the possibility for better correlating benefit, but the classification system will improve. Certainty can be obtained only by the study of many samples. To this end the writer asks the help of all and invites everyone to have "muskeg" samples sent to him from any area in Canada.

The system is the first ever devised to assist in identifying and distinguishing "muskeg" samples; to reveal and to record the organization in "muskeg"; and to serve as a basis of appraisal for "muskeg" structure and its mechanical properties. It will be used also for opening the way to intelligent aerial interpretation. The attempt to establish this to the exclusion of botanical expressions has been deliberate, in order that all who work with "muskeg" and who are interested in it may use the system and make suggestions in the anticipation of refinement and improvement. There is much to be contributed to the new and specialized field of applied botany on which "muskeg" interpretation depends—a field which for want of a better expression has been designated as palaeovegetography!

Acknowledgements

The writer wishes to acknowledge the interest of the National Research Council and the Defence Research Board, which have provided financial assistance towards this and related investigations. Special thanks are due to Robert F. Legget, Chairman of the Associate Committee on Soil and Snow Mechanics, National Research Council, and Director of the Division of Building Research of the National Research Council of Canada. He has been a source of sustained inspiration and encouragement.

To colleagues, assistants and students whose help in the field and in the laboratory and whose interest in "muskeg" continues, the writer is grateful. Appreciation is due also to Colonel Graham W. Rowley, Arctic Research Section, Defence Research Board, and to members of the "Sub-Committee Muskeg" of the Associate Committee on Soil and Snow Mechanics, N.R.C., for their encouragement, criticism and suggestions. √

CANADA...ENGINEERING OPPORTUNITIES UNLIMITED

(*Continued from page 1187*)

exporting to the United States such articles, formerly imported, as noiseless typewriters, stainless steel equipment and hollow ware, acetylene black and baby carriages. We are also exporting such manufactured articles which many of our customers used to buy from the United States as optical goods, electric heating elements, high carbon bits and automatic washing machines. In the aviation field there is the De Havilland Beaver which overcame the "Buy American" prejudice. And an even more sensational example is the cobalt bomb for medical therapy.

Canada obviously has a major role to play in the great "Atlantic" triangle, not only as the traditional interpreter between the United Kingdom and the United States, but also to make a real contribution to the partnership in the industrial and general scientific field.

The first half of the twentieth century saw Canada's growth as an independent nation in many fields of endeavour, including aviation. Although we have gone through an industrial revolution of great consequence, we still have not declared our industrial independence. Behind us is the past, to which we can never return. Ahead is the Jet or Atomic Age which could truly belong to Canada, because of our potential in these sources of energy.

You will agree Canada is at a crucial development point. How we think and act now will have a very real influence on whether we be-

(*Continued on page 1219*)

FROM MONTH TO MONTH

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

One Hundred Years of Service

The great thing about the centennial of the American Society of Civil Engineers was not the 66 ring circus held in Chicago in September to mark the occasion, but the realization that a society on this continent had given 100 years of service, of inspiration and of leadership to the profession. This great society, organized by a few enthusiasts, and pioneers had grown from a scrawny childhood to a robust adulthood, reaching in its 100th year a membership of 34,000 served through 73 sections.

It doesn't take long to say "a hundred years"—it doesn't seem long to look back at 100 years, but a moment's reflection reveals that 100 years of service is a lot of service. No other engineering society on this continent can show such a record. Throughout all those years the Society was active, aggressive and progressive, never yielding the place of leadership which it had attained in the beginning. Its efforts have been an important factor in the development of the profession and in the attainment of the engineer's enviable status today. It is work such as that performed by A.S.C.E. that has raised the calling from a trade to a profession and from a profession to a learned profession. All engineers, no matter in what branch they have specialized are indebted greatly to the American Society of Civil Engineers.

At Chicago

About 28,000 engineers gathered in Chicago between September 3rd to 13th to do honour to the parent society. They were members of the 66 societies that were official participants in the program. The Institute as the only Canadian organization participating was proud to be in such good company. Meetings were held by the various organizations in more than a dozen hotels with about a dozen going on at the same time, day after day. It was a

Early purchasers of the Centennial stamp. James A. Vance, E.I.C. past-president; Wm. K. Brasher, secretary, British Institution of Electrical Engineers; Wm. N. Carey, secretary, American Society of Civil Engineers; Rudolfo E. Ballester, professor, University of Buenos Aires.

Cover Picture

Site of the Sir Adam Beck No. 2 power house of the Ontario Hydro Electric Power Commission. Note openings through rock at top centre and slots down the face of the cliff, for the individual penstocks leading out of the forebay down to the hydraulic turbines, which will be located in the power house at the foot of the cliff.

For additional details see "Construction Methods on Ontario Hydro's New Niagara Power Development" page 1175, of this issue.

At the reception. Left to right, Otto Holden, Toronto; F. Saturnino de Brito, filho, Brazil; C. J. Mackenzie, Ottawa.

The field secretary in good company. Dr. Lillian Gilbreth; Past-President L. F. Grant, Mrs. Charles Disney.

The receiving line. President J. B. Stirling and Mrs. Stirling; Past-President C. J. Mackenzie; Past-President James A. Vance and Mrs. Vance.

As a "token of admiration and esteem", the Institute presented to A.S.C.E. an antique clock.

veritable maze of meetings that required a program of 265 pages to list them.

In attempting to set down even a sketch of what transpired one is hopelessly confused. What events were the important ones ? What were the most significant ? What were the most interesting ? Doubtless no two people would agree on the answers, even among those who attended, and so this account does not attempt to answer these questions, but instead will make reference to events that would seem to have most interest for Canadians.

The big day of all according to the program and the publicity was Wednesday, September 10th, referred to as Centennial Day. The main events were the luncheon and the dinner. Each was outstanding, but for different reasons. The luncheon was held in the magnificent grand ballroom of the Conrad-Hilton Hotel. It's purpose was to do honour to two outstanding engineers, Rt. Hon. C. D. Howe, an Honorary Member of the Engineering Institute, and Minister of Trade and Commerce and Defence Production, and Mr. Benjamin Franklin Fairless, president United States Steel Corporation.

Honours for C. D. Howe

Mr. Howe was awarded the Hoover Medal, for "distinguished public service". This is one of the really great honours awarded to engineers, and is named for its first recipient, Mr. Herbert Hoover, who happily was present at head table on this occasion. The medal was presented by Mr. Scott Turner, chairman of the Hoover Medal Committee.

Mr. Fairless received the John Fritz Medal from R. E. Dougherty, chairman of the committee, awarded for "notable scientific and industrial achievement". Both Mr. Howe and Mr. Fairless spoke, as did also Mr. Hoover. These were three remarkable addresses and the *Journal* is pleased to present each of them in turn in succeeding numbers.

The great thing about this function was the dignity that attended every detail (except for the press photographers) and the excellence of all the speeches. It was indeed a proud occasion for all engineers, a real demonstration of professional status and achievement.

The evening event was referred to as the "Centennial evening party". The program said it was planned "as the all-inclusive function of the convocation". The planning was certainly most elaborate and doubtless "all inclusive", but it fell far short of the excellence of the noon function or the Honorary Members' dinner of the previous Saturday.

The location of the dinner was the International Amphitheatre, better known to Canadians as the location of the Democratic and Republican Conventions. There were about 2,500 present for dinner and the whole experience was a bit confusing to say the least. After dinner the company moved in to the adjacent arena to see a special presentation of an elaborate ice show. The real feature of the evening's program was a short talk by Charles F. Kettering "A Review of the Century". This was probably the largest group of engineers ever to come together any place in the world, which made it an outstanding event, but such numbers made impossible the attainment of many features usually thought desirable for a professional meeting.

Another event of special interest to Canadians was the Honorary Members Dinner on the evening of Saturday, the 6th. On this occasion Honorary Memberships were presented to five distinguished engineers, one of them being Dr. C. J. Mackenzie, Hon. M.E.I.C., president of the Atomic Energy of Canada Limited. The other four were Andre Coyne of France, E. G. Bailey, U.S.A., Ary F. Torres of Brazil, and Harvey S. Mudd, U.S.A.

E.I.C. Representation

In recognition of the centennial and in appreciation of the friendly relations between the two organizations the Institute presented to the American Society of Civil Engineers a clock bearing this inscription:

> "Presented to the American Society of Civil Engineers, on their one hundredth anniversary, by the Engineering Institute of Canada. A token of admiration and esteem".

In making the presentation, J. B. Stirling said:

"The Institute recognizes the outstanding leadership, the splendid accomplishments and the wide influence of this great society, and gratefully acknowledges the many kindnesses that have been so freely given.

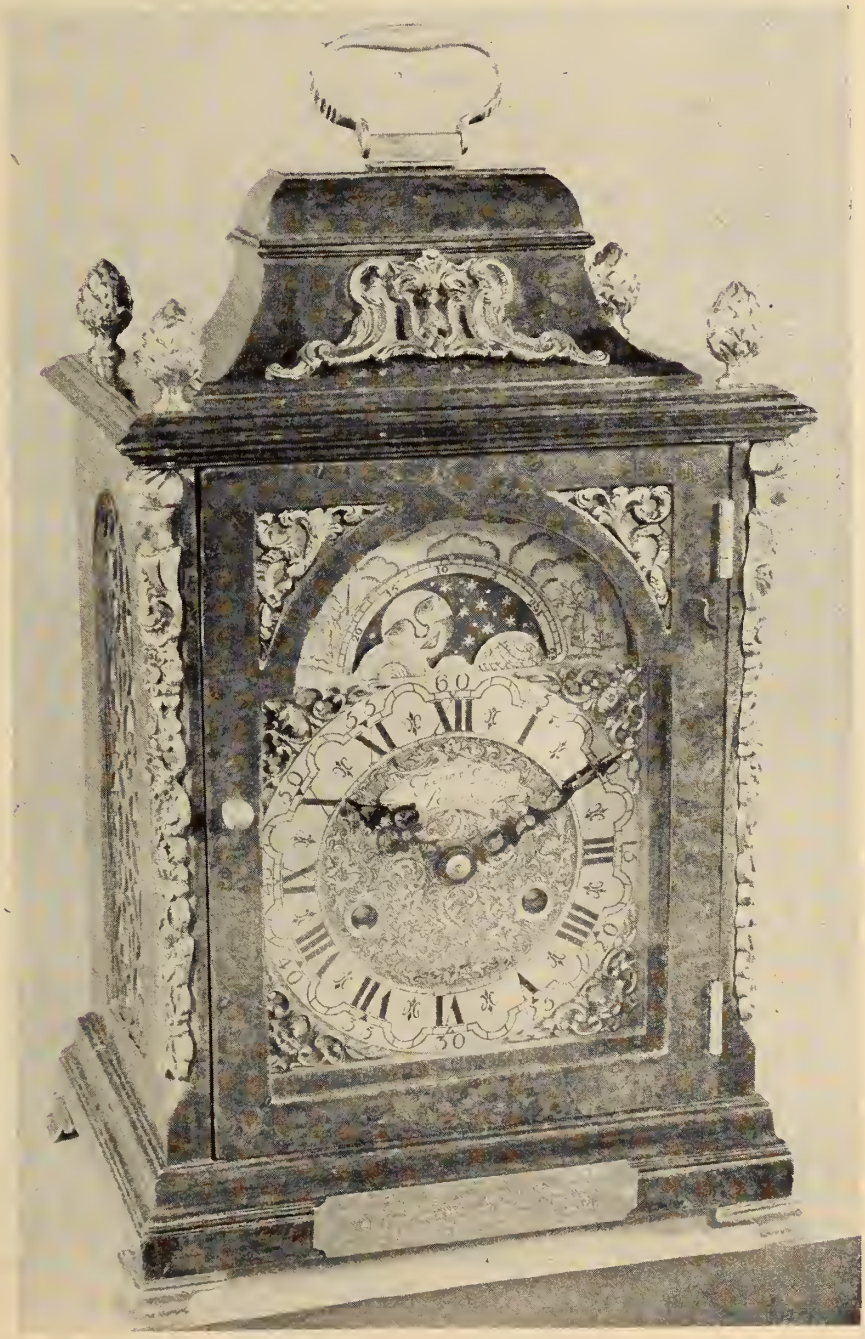
"As a token of the fine friendship between our organizations the Institute presents this clock which it is hoped will be a worthy partner with you in rendering another one hundred years of useful service to your members and your nation".

E.I.C. Reception

On the afternoon of Friday 5th, the Institute held a reception in the south ballroom of the Conrad Hilton Hotel. The receiving line was made

up of president J. B. Stirling and Mrs. Stirling, past president C. J. Mackenzie, past president James A. Vance and Mrs. Vance. There were about 300 in attendance.

All the members resident in the United States and those from Canada who were attending the centennial were invited. The company also included the Institute's two women members, Dr. Lillian Gilbreth and Elsie McGill. The Institute was honored by the presence of Sir John Hacking, president of the Institution of Electrical Engineers, Carlton S. Proctor, president of the American Society of Civil Engineers, Reg. J. S. Piggot, president of the American Society of Mechanical Engineers, William I. Burt, president of the American Institute of Chemical Engineers, Luis Giannattasio of Uruguay, president of Upadi, and representatives of engineering societies from Norway, France, South America, Australia and South Africa. The British Consul General, B. E. F. Gage, C.M.G., and the Canadian Consul General, Douglas S. Cole, were special guests.



Achievement

It must be a matter of great gratification to the officers and staff of A.S.C.E. that the centennial was so successful. It took years of planning and arranging, and in the process there were many setbacks, disappointments and worries, but "all's well that ends well", and this surely ended well.

It was a great compliment to the society that 66 sister organizations took an official part in the program. Almost every country in the world (outside the iron curtain) where engineering is established was represented .This coming together of so many societies, so many countries,

Past-president C. J. Mackenzie received a certificate of honorary membership from Carlton S. Proctor, president of A.S.C.E., while Gail Hathaway, past-president of A.S.C.E. looks on.

so many engineers is of genuine significance in a world as torn by different beliefs and objectives as is the world today. Surely such a meeting of people and minds must be important to the maintenance of peace.

The Institute joins with societies everywhere to wish the American Society of Civil Engineers the same success as enjoyed in the past, and looks forward to continued association with it in its good works in the future.

Distinguished Guests from Great Britain

It is not often that Canada gets in one group so many distinguished overseas engineers as was her fortune in September when the three presidents and three secretaries of the British institutions of civil, electrical and mechanical engineers spent eleven days in this country as guests of the Institute. The gentlemen were Sir John Hacking, president, and W. K. Brasher, secretary, Institution of Electrical Engineers; Sir David Pye, president, and Brian G. Robbins, secretary, Institution of Mechanical Engineers; Mr. Allan Quartermaine, president, and E. Graham Clark, secretary, Institution of Civil Engineers.

The primary object of the visit to North America was the Centennial of Engineering in Chicago, at which these gentlemen were special guests. However, because of the close relations established between these three institutions and the Institute through the Conference of Commonwealth Engineering Institutions, the British institutions arranged for their officers to spend almost as long in Canada as in the United States.

The tour through Ontario and Quebec was handled by various Institute representatives who gathered around them enthusiastic assistants resident in the areas. The Institute is greatly indebted to these people and at the October meeting of Council a resolution of thanks and appreciation to them all was passed enthusiastically. According to reports from the guests themselves they did an excellent piece of work as guides and hosts.

It was at Detroit that the guests were transferred from the Americans to the Canadians. All the travel arrangements from there to Toronto were in the hands of past-president James A. Vance. The three motor cars of his convoy were chauffered by himself, Dr. B. B. Hillary and Col. H. A. MacKay of London.

From Detroit the route took them to Windsor and then south through Amherstburg, Kingsville, Leamington with a stop at Glen Gordon Manor near Blenheim for dinner. After dinner they drove to Sarnia where they stayed for the week-end at the staff house of the Dow Chemical Company on the banks of the busy St. Clair River.

Sunday was spent quietly (?). In the morning there was a drive around Sarnia and an outside view of many of the tremendous industries of that area, including the new Canadian Oil Company Refinery, the Polymer plant, the Imperial Oil Refinery and others. From there they went on to see the grain elevator at Point Edward, the Blue Water Bridge, the Narrows where Lake Huron empties into the St. Clair River and the protective work along the shore line of Lake Huron.

In the afternoon the party was entertained at the home of Dr. Hillary overlooking the St. Clair River. After dinner about twenty members of the branch came to the Staff House for an informal visit.

Early Monday morning the "safari" with Vern King replacing Dr. Hillary and G. G. Grant replacing Col. MacKay got under way again, with Niagara Falls as the ultimate objective. On the way they stopped at Western University in London where they were met by Dr. Hall, president of the University, members of his staff and about fifteen members of the branch. An informal reception and a cup of coffee featured this stop.

The next stop was Woodstock where Mr. Vance entertained the group at his home. Luncheon was served at the New Commercial Hotel where about twenty engineers joined the party.

From Woodstock the trail led to Hamilton and McMaster University where Dr. Gilmore the president with some members of his staff and thirty members of the Hamilton Branch received the visitors. Two distinguished members of the local group who were warmly welcomed were H. G. Bertram and E. H. Darling.

The course through Hamilton was set by Councillor W. E. Brown who led them eventually to the main highway and the Welland Canal. Here the guests were delighted to see the same ship that had passed them at Sarnia, the John McKellar. 22,500 tons, on her maiden trip. On the way to Niagara Falls the route led to Fort Erie and thence through Chippawa to the General Brock Hotel. After dinner a number of the local members made an informal call.

Saturday morning, under the guidance of R. L. Hearn, Otto Holden and William Hogg, the visitors were shown over and through the new Hydro Electric Power Commission project, and then on to Queenston Heights where luncheon was served. In the afternoon a quick visit was made to

the Ontario Paper Company plant at Thorold. Here Mr. Gordon Godwin and officials of the company greeted the guests. At the twin locks of the Welland Canal, H. E. Treble, division engineer, and members of his canal staff met the party.

Driving over the Queen Elizabeth highway, the party arrived at the Royal York, Toronto, about 7 p.m., but on the way the Britishers each were presented with a box of delicious ripe peaches which were an important part of their baggage from there to Montreal.

At Toronto

Dinner was at the Granite Club where the party were guests of Dr. J. M. Thomson of Ferranti Electric who also was chairman of the Canadian committee of the Institution of Electrical Engineers. Tuesday was a full day for sure, with a tour of the engineering buildings at the University under the guidance of Professor E. A. Allcut. Hart House was the setting for the luncheon, and Dr. Sydney Smith, president of the University, was on hand to extend a welcome.

For dinner the party were guests of the Toronto Branch with W. H. Paterson of Toronto Transportation Commission as chairman. The location was the Royal York Hotel and the party numbered thirty. After dinner there was a joint meeting at the University for members of the three British Institutions and the Engineering Institute. The visitors departed on the night train for Ottawa, and Mr. Vance and his able assistants returned to their homes.

Toronto had an excellent joint committee in charge of arrangements with Edgar Cross representing the civils, Professor Allcut, the mechanicals, Dr. Thomson the electricals, and W. H. Paterson the E.I.C. They turned in an excellent performance which greatly pleased the visitors.

At Ottawa

The next phase of the tour opened at Ottawa on Thursday, September 18th. The president of the Institute, Dr. J. B. Stirling, met the guests on the arrival of their train and all had breakfast together. The general secretary also joined the party in Ottawa. The first item was a visit to the president of the National Research Council, Dr. E. W. R. Steacie, after which the group was divided into civils, mechanicals and electricals for tours of the buildings, each according to his specialty.

The Institute entertained the group for luncheon at the Country Club. Here the visitors had the opportunity to meet ministers of the Crown, deputy ministers, past-presidents, officers of the branch and other distinguished Ottawa citizens. A most welcome and colorful guest was Her Worship Mayor Charlotte Whitton who in seven minutes gave a stirring account of the engineers and their work around that area under the distinguished military engineer Colonel Bye. Dr. Stirling, presided and Mr. Quartermaine expressed the thanks of the British delegation.

Among the guests were the Rt. Hon. C. D. Howe, Minister of Trade and Commerce and Defence Production; Hon. Robert H. Winters, Minister of Resources and Development; Lt. Gen. Sir Archibald Nye, High Commissioner for the United Kingdom; General the Hon. A. G. L. McNaughton of the International Joint Commission; Dr. C. J. Mackenzie, president of Atomic Energy of Canada Limited; E. P. Murphy, Deputy Minister, Public Works; Dr. E. W. R. Steacie, president, National Research Council; C. H. Bland, chairman, Civil Service Commission; Col. J. R. B. Jones, Chief Engineer, National Defence—Army; J. H. Irvine, Commissioner of Works, Ottawa; Robert Blais, Chief Engineer — Public Works; J. H. Parkin, director, Aeronautical Establishment, National Research Council; R. G. Johnson, president, Defence Construction Limited and the following members of the branch executive, T. Foulkes chairman, W. R. Meredith secretary-treasurer, B. G. Ballard and A. C. Ross councillors, H. F. Crain, R. E. Hayes, R. F. Legget, J. S. Watt and J. D. Whittaker.

In the afternoon the visitors were shown around Ottawa.

British visitors and E.I.C. officers at Seigniory Club, Montebello, Que. Left to right, E. Graham Clarke, R. E. Heartz, R. L. Dunsmore, Sir John Hacking, A. S. Quartermaine, I. R. Tait, J. B. Stirling, Mrs. R. L. Dunsmore, Sir David Pye, Mrs. J. B. Stirling, R. E. Chadwick, R. L. Weldon.

Luncheon reception to British engineers at Beaconsfield Golf Club, Montreal. Left to right: deGaspe Beaubien, J. S. Cameron, A. S. Quartermaine. P. L. Pratley, E. Graham Clark, Sir John Hacking, I. R. Tait, Sir David Pye, Henri Gaudefroy, F. P. Shearwood, F. L. Lawton, A. W. Whitaker, Jr.

Luncheon reception to British Engineers, Country Club, Ottawa. Left to right: Dr. J. B. Stirling, president of the Institute, Sir David Pye, president, the Institution of Mechanical Engineers, Rt. Hon. C. D. Howe, Minister of Trade and Commerce and Defence Production; A. S. Quartermaine, president, the Institution of Civil Engineers; Miss Charlotte Whitton, Mayor of Ottawa; Sir John Hacking, president, the Institution of Electrical Engineers; Hon. R. H. Winters, Minister of Resources and Development; Dr. E. W. R. Steacie, president, National Research Council.

At 5.30 there was a reception at the National Research Council for members of the three British Institutions and the Engineering Institute. Here all three presidents spoke and later had short meetings with their own members. This was followed by tea in the cafeteria. After the reception the executive of the branch were hosts at a buffet dinner at the Rideau Club.

To Montreal

Friday morning saw the visitors in two carloads with the president and general secretary at the wheels on the way to Montreal. The party stopped at Ste. Anne de Bellevue to make a quick inspection of the Gas Dynamics Laboratory with Professor Mordell in charge. Dean R. E. Jamieson and Professor C. A. Robb joined the party here.

From Ste. Anne the convoy travelled to the Beaconsfield Golf Club at Pointe Claire where a buffet luncheon was served. Here again were assembled about thirty leading engineers from Montreal to meet the distinguished guests. In the group, besides the president and guests, were:

F. L. Lawton, Chairman, Montreal Branch E.I.C.; Chief Engineer, Aluminium Laboratories Limited.
J. S. Cameron, Vice-President, Northern Electric Company Ltd.
C. A. Robb, Professor of Mechanical Engineering, McGill University.
P. L. Pratley, Consulting Engineer.
G. N. Martin, Vice-Chairman, Montreal Branch E.I.C.; Combustion Sales Engineer, Dominion Bridge Co.

Past-Presidents of the Institute

deGaspe Beaubien, Consulting Engineer.
F. P. Shearwood, Consulting Engineer, Dominion Bridge Co.
Arthur Surveyer, Consulting Engineer.
Irving R. Tait, Vice-President E.I.C.; Consulting Engineer, Canadian Industries Ltd.
R. E. Jamieson, Treasurer E.I.C.; Dean of Engineering, McGill University.
J. M. Breen, President, Canada Cement Company Limited.
R. E. Heartz, President, Shawinigan Engineering Company.
A. W. Whitaker, Jr., Vice-President and General Manager, Aluminum Company of Canada.
R. B. Wotherspoon, Secretary-Treasurer, Montreal Branch E.I.C.; Project Engineer, Dominion Textile Co., Ltd.
Henri Gaudefroy, Assistant to the Dean and Registrar Ecole Polytechnique.
L. L. O'Sullivan, President, Corpoation of Professional Engineers of Quebec; Assistant General Manager, Quebec Hydro Electric Commission.
L. M. Nadeau, General Secretary, Corporation of Professional Engineers of Quebec.
A. L. Penhale, Vice-President, Canadian Institute of Mining and Metallurgy; President, Asbestos Corporation Limited.
Carlyle Gerow, Secretary-Treasurer, Canadian Institute of Mining and Metallurgy.
R. S. Jane, President, Chemical Institute of Canada; Vice-President i/c of Research and Patents, Shawinigan Chemicals Limited.
Garnet T. Page, General Manager, Chemical Institute of Canada.
Arnold Heckle, United Kingdom Trade Commissioner.
John Thomson, General Manager, Ferranti Electric Ltd., Toronto.
L. Austin Wright, General Secretary.
H. G. Thompson, Assistant General Secretary.
E. J. Blandford, Publications Manager.

The next item was a press conference and more photographs at Institute Headquarters. Through some miscalculation there was about an hour left free just here, which the visitors used in various ways, but mostly resting.

The local committee made up of

The secretaries pose at Ottawa. Left to right: E. Graham Clark, I.C.E.; Brian G. Robbins, I.M.E.; W. K. Brasher, I.E.E., and L. Austin Wright, E.I.C.

F. L. Lawton for the Institute, Dr. P. L. Pratley for the Civils, Prof. C. A. Robb for the Mechanicals, and J. S. Cameron for the Electricals, had arranged for dinner at the Faculty Club, where about forty engineers chosen in equal numbers from each organization joined the visitors.

After dinner, all three presidents spoke to a joint audience of over two hundred in the engineering building of McGill University. Then the group broke up into three separate meetings in three different lecture rooms, so that the officers of each institution could talk with their own members. At the conclusion of these meetings all assembled in the foyer for sandwiches and coffee, which concluded Friday's program.

The Week-end

Saturday morning was devoted to sightseeing in Montreal or to shopping, after which luncheon was served at the University Club. After luncheon the visitors again embarked in the motor cars for the ride to the Siegniory Club. Now the party was enlarged by the addition of Mr. and Mrs. R. E. Heartz, Mr. and Mrs. R. L. Dunsmore and I. R. Tait. At the Seigniory Club the group was still further enlarged by Mr. R. L. Weldon and his daughter, and Mr. and Mrs. R. E. Chadwick.

On to Shawinigan

Eight-thirty Monday morning saw three car loads leave the Club for Shawinigan Falls with Messrs. Heartz, Dunsmore and Wright at the controls. At 2 p.m. all were at the Cascades Inn, Shawinigan Falls where a delightful buffet luncheon was waiting. The balance of the afternoon was devoted to a trip through Shawinigan's new power station.

That night Mr. Heartz entertained the group with the addition of a few local engineers to an outstanding dinner—doubtless the best meal of the tour (which is saying a lot). So outstanding was the occasion that the chef was invited into the dining room to receive the thanks and praise of all. Sir David Pye was the spokesman and did a delightful job of it.

Tuesday morning afforded an opportunity for a tour of Shawinigan Falls and an outside inspection of the many industries. Then the group called upon the Mayor at the City Hall, signed the golden book, were photographed again, and embarked for Quebec.

The autumn leaves were not at their best. It was about a week too soon, but there were enough to give the visitors an idea of how beautiful this country could be. The glimpses of the St. Lawrence that break through to the highway, like the partly coloured leaves gave an impression of how grand the river could be if it could but be seen properly. Quebec is a beautiful province to show to people from another land—particularly people like these who have seen something of the world and therefore know values. It was a pleasure to have the privilege of showing it to them.

At Quebec City

As usual, the City of Quebec showed off to advantage. There was not enough time to see it well, but short sorties on Tuesday afternoon and Wednesday morning gave some idea of its unusual beauty and historic background. Of course the Quebec Bridge had to be seen and the ramparts, Plains of Abraham, Governor's Garden, the Terrace, and so on.

On Tuesday night the branch entertained the party at dinner at the Cercle Universitaire, with the branch chairman, Georges Demers, presiding. Wednesday morning gave opportunity to visit the Faculty of Science and Engineering of Laval University, where Dean Adrien Pouliot welcomed them and Professor L. P. Bonneau showed them over the labs and class rooms. Luncheon was had at the Garrison Club.

In the afternoon the bags were packed for the last time in Canada, and the Institute's gracious guests embarked on the *Scythia* for their homeland.

It was a rare privilege to have these gentlemen in Canada and to show them something of the central provinces. It was too bad that time did not permit of a more extensive

(*Continued on page 1219*)

Last stop and last photograph. The Britishers in company with R. E. Heartz and the general secretary, pose for the last time beside the Chateau Frontenac. Left to right: R. E. Heartz, W. K. Brasher, Allan S. Quartermaine, Sir David Pye, Sir John Hacking, L. Austin Wright, and E. Graham Clark.

"Wanted: A Better Way"

Remarks of Benjamin F. Fairless, Chairman of the Board and President, United States Steel Corporation, in accepting The John Fritz Medal Award at the Centennial of Engineering, Chicago, Illinois, September 10, 1952.

This is one of the greatest honors that has ever come to me; and I wish that I could tell you how deeply I appreciate the much-too-generous words that have been spoken here about me. But perhaps that won't be necessary. If you had been called as many purple names as I have during the past few months, you would know how nice it is to hear a dissenting opinion.

No award which comes to a man in the course of his career ever means quite so much to him, I suppose, as one that is conferred upon him by the members of his own profession—by the men who are most familiar with his faults and failings, and who are still willing to look beyond them in search of something to praise. And this one is doubly welcome to me, as a steel man, because it was established in honor of John Fritz—one of the truly great figures in this century of engineering progress that we are celebrating here today.

John Fritz contributed enormously to the science and technology of steelmaking; but he contributed even more importantly to the integrity of the steel industry and of its product. Unless the furnaces and mills, which he designed and built and ran, could turn out a product that was in line with the best on the market, he wanted no truck with them at all.

It was this pride of honest workmanship, and this contempt for mediocrity, that distinguished his whole career and left its indelible mark—not only upon the steel industry—but upon the entire engineering profession in every field of enterprise.

Surely we would have little to fear in this world today if that same, uncompromising passion for integrity prevailed in every walk of life—especially in government.

And so, gentlemen, it is with a great deal of pride and a deep sense of humility that I accept this medal. When I look back upon the men of real genius who have won it in the past, and when I think of their magnificent contributions to our welfare and our way of life, I can only marvel at the size and power of the magnifying glass that your committee must have used in viewing my own limited accomplishments. It is true—as has been said here—that I have tried to champion the American free enterprise system. I have preached it, and I have also practised it; but it was you who built it and made it the most productive system on this earth.

Perhaps that is why I have always been so proud of my engineering training, and why I look back with such pleasure upon the days—some 40 years ago—when I received it. At that time, of course, I dreamed of building railroads and bridges and skyscrapers; but instead I started out by building an open hearth and ended up in the steel business.

I do not regret that, nor would I change it if I could; but from my own personal experience, over these forty years, I have learned one thing: that an education in engineering fits a young man for almost any occupation he may wish to pursue in later life.

I can think of no other profession which places a greater premium upon accuracy and precision. The engineer can never afford to guess at the facts. He cannot assume that a certain girder will withstand about so much stress or that a certain beam will support about so much weight. He must know his facts completely and exactly; and he must be governed by them absolutely, for if he is only 99 per cent right, he is likely to be 100 per cent wrong, and his bridges will end up in the drink.

And so it is, of course, with anything else which men build—whether it be an open hearth, an economic system or a government. All of them must be engineered in strict accordance with the facts, and the builder who tries to remodel our economy, and who twists those facts to conform to his personal wishes, his emotional whims, or his political theories, is courting disaster for us all.

That is why I believe that in every part of our society, America needs, as never before, the disciplined mind of the trained engineer—a mind that is eternally dedicated to the pursuit of truth, and rigidly governed by the facts of our national life. And because you, here, possess that type of mind, I want to discuss with you—in the few minutes that remain to me—a subject which may seem to you to lie far outside the normal scope of the engineering profession, but which—to my way of thinking—is the most important item of unfinished business that confronts us today.

And the unfinished business to which I refer is the matter of our human relations in industry.

We have met here today to celebrate the Centennial of Engineering in America and to congratulate ourselves upon the great part which American engineering has played in the somewhat wayward march of mankind "From Adam to Atom". We take pride in the fact that the scientific and engineering miracles which have been performed in this country during these past hundred years have never been equalled by any other nation on earth at any period in the recorded history of the world.

But I wonder how many of us realize the alarming extent to which our advances in the scientific and engineering fields are now being wiped out by our failure to make similar progress, as a nation, in the field of human relations. Let me give you one startling example among the many hundreds which probably might be cited:

Since the end of World War II the American steel industry has been engaged in a vast program of expansion which has added an average of about 2½ million tons each year to its ingot capacity. Yet during this same period it has lost about seven million tons of ingot production each year as a result of strikes. That means that for every ton of capacity we have added, we have lost nearly three tons of production.

At Morrisville, Pennsylvania, United States Steel is now building the largest integrated steel plant that has ever been constructed in so short a time; yet it will take this plant ten years to turn out as much tonnage as our nation lost in less than eight weeks, this summer.

Obviously, gentlemen, the time has come when it behooves all of us to search for a better way to settle our labour disputes. The American people are patient, but they will not sit by forever and permit strikes to endanger our national defense, to impede our industrial progress and to wipe out the savings of thousands of workers, many of

whom—in some cases—are not directly involved in the controversy. Ultimately, the force of public opinion is going to compel drastic action in Washington—action which can only result in the further suppression of our precious liberties.

Already we hear it suggested that the right to strike be abolished completely in periods of national emergency. That way, I think, lies slavery, and I do not see how any thoughtful American can support such a proposal.

Elsewhere, we hear an increasing demand for government arbitration of labor disputes. That way, I believe, lies the eventual nationalization of industry and the murder of free enterprise; for it seems clear to me that if wages and other major production costs are to be dictated by any government-appointed agency, then the government itself must soon take over our industries and assume direct financial responsibility for the consequences of its decisions. Should that occur, of course, it would also mean the end of labor's right to strike, for the right to strike against the government is already denied by law.

So either of these proposals must lead to the suppression of individual freedom and both are therefore fundamentally wrong. I do not mean to suggest, however, that there is no need for government action in this field. There is.

I believe that government must fix the rules under which the collective bargaining process is to operate —rules that are fair to both sides and that are enforced, firmly, and without favor. I also believe that some future Congress must face up to the question of labor monopoly just as past Congresses have clamped down on industrial monopoly.

But I do not believe that political interference with the collective bargaining process itself can ever produce anything but more industrial conflict. Government intertvention does not prevent strikes—it invites them. And it always will as long as one party or the other has a better chance to get a favorable settlement from its political friends in Washington than it has at the bargaining table.

We learned this under the labor board in the last war. We are learning it again today under the administration of wage and price controls; and if we didn't learn it during the recent steel strike, then heaven knows, we are incapable of learning anything!

Clearly, gentlemen, we cannot look to government for the final answer to this problem. We must solve it for ourselves. It is a responsibility that rests upon all of us —and especially on management and labor. There must be a better way of settling our differences than just by slugging them out at the expense of the entire nation. There must be a better way of using our freedom than by undermining our ability to defend that freedom. And clearly there is. Our job is to find it.

I believe that this nation has a right to expect American labor and management to bargain in a spirit of reason and decency. I believe it is fed up to the gills with name-calling, mud-slinging and personal abuse. I believe it expects labor to use the strike only as a weapon of last resort—not as the opening gun in a campaign for tactical advantage. I believe it expects management to respect and defend the right of its workers to bargain, voluntarily, through unions of their choosing. I believe it expects both of us to live and to let live—to recognize that our long-range interests are identical . . . not antagonistic . . . and that anything which injures one of us will gravely jeopardize the security of the other.

In short, it expects us to substitute co-operation for conflict; and to end this industrial warfare once and for all.

That is a large order. It is a task to challenge the finest minds in the land. It will demand infinite patience and endless perseverance. But if it can be accomplished, it will stand out—I think—as the greatest contribution of this century towards the industrial development of America. And so I commend it especially to your thoughts on this occasion.

One way to approach this task, it seems to me, is suggested by a passage in the autobiography of John Fritz himself. He writes:

"In all my experience, I have always sought to secure and retain the good will of the workmen. With confidence fully established between workmen and their employer, strikes rarely occur".

But times, of course, have changed greatly since that was written. In these days of mass production and mass employment, when our plants are scattered from one end of the land to the other, it is practically impossible for employers in a large industry to talk with their men at all . . . to exchange views and to discuss their mutual problems and interests.

It is this fact, above all else, I think, that has led to the rapid deterioration of our human relations in industry. And that is why Philip Murray and I have agreed to set out, this Fall, on a series of trips to the various plants of United Steel. We plan to sit down at the dinner table with the local representatives of the union, and of the plant management, and talk things over. We want to tell each other our troubles, and help each other to find a solution for them. And we hope, in this way, to stop a lot of the friction at its source. In the end, we may even discover that we're not antagonists after all; but just partners and friends.

I do not know what luck we shall have. I do not know that we shall accomplish anything at all. But I do know that both of us will sincerely try to find "a better way".

DISTINGUISHED GUESTS FROM GREAT BRITAIN

(*Continued from page 1217*)

tour, because there are so many more parts of Canada of which all Canadians are proud, but this short journey did allow for meetings with many members of their own institutions and many other engineers as well. It gave them at least a glimpse of Canadian scenery, Canadian industry and Canadian opportunity.

If their pleasure in the visit was of as great a measure as was that of those who met them, they will count the experience a happy one and perhaps will return another time. √

CANADA . . . ENGINEERING OPPORTUNITIES UNLIMITED

(*Continued from page 1210*)

come a major world power or continue to be a secondary nation. The engineering profession, as you know, has much influence in this regard. Let us as a profession and as a nation resolve to grasp the wonderful opportunities available to us. Let us continue to design and develop our own Canadian products, and thus enhance the opportunities for Canadian engineers. Let us learn to walk by ourselves. √

R.C.E.M.E. Corps Association Meeting

Association Holds Seventh Annual Meeting at Barriefield, Ontario

The seventh annual general meeting and annual dinner of the Royal Canadian Electrical and Mechanical Engineers Corps Association were held on Saturday, October 25 at the R.C.E.M.E. School at Barriefield, Ontario.

The meeting was convened by the president, Lt.-Col. J. E. H. Stethem of Montreal with the following delegates in attendance: Lt.-Col. J. K. Bradford, O.B.E., Toronto, Central Command Chapter; Lt.-Col. W. E. MacInnes, Vancouver, Western Command Chapter; Major D. D. Campbell, Montreal, Quebec Command Chapter; Major O. B. Berringer, E.D., Halifax, Eastern Command Chapter.

The following officers for 1952-53 were elected: President, Lt.-Col. F. W. Cranston, E.D., Toronto; Secretary-Treasurer, Lt.-Col. LeSueur Brodie, E.D., Toronto.

The following principal guests were in attendance at the annual dinner: Dr. O. M. Solandt, O.B.E., chairman, Defence Research Board; Brig. M. S. Dunn, O.B.E., E.D., Eastern Ontario Area Commander; Major-General A. E. Potts, O.B.E., representing the Candn. Infantry Association; Lt.-Col. L. F. Grant, chairman, Engineer's Council for Profession Development, and field secretary of Engineering Institute of Canada; Lt.-Col. T. M. Medland, executive director, Association of Professional Engineers of Ontario; Major G. M. Billings, representing Canadian Signals Association; Major P. T. Nation, representing Canadian Artillery Association; Capt. L. E. Eadie, representing Royal Canadian Ordnance Corps Association; Brig. G. M. Grant, C.B.E., chairman, Conference of Defence Associations.

The guest speaker at the dinner was Dr. O. M. Solandt, O.B.E., chairman of the Defence Research Board, who has just returned from witnessing the British atomic bomb test. Dr. Solandt visited Sir William Penney in England and flew with him to Australia, where after visiting the rocket range and most of the capital cities he was privileged to witness the test.

He stated that Mr. Churchill's recent public announcement covered the results of the test as fully as could be reported and that very complete scientific data had been obtained covering practically every phase of the effects.

Dr. Solandt then went on to elaborate on the importance to the R.C.E.M.E. Corps of being informed as to the effect which atomic warfare would have on their work of recovery and repair of equipment. He also stressed the desirability of having R.C.E.M.E. personnel trained in protection against atomic attack on their own workshops as well as removing the effect of such attacks on the equipment with which they had occasion to deal.

Attending the annual meeting of R.C.E.M.E. Corps Association. Left to right: Lt.-Col. L. F. Grant, M.E.I.C., Lt.-Col. LeS. Brodie, E.D., Col. J. R. Dunlop, O.B.E., M.E.I.C.; Lt.-Col. F. W. Cranston, E.D.; Dr. O. M. Solandt, O.B.E., Affil. E.I.C., Col. H. G. Thompson, D.F.C., E.D., M.E.I.C.; Lt.-Col. T. M. Medland.

Forthcoming *Journal* Papers

The following papers are scheduled to appear in the December issue:

Performance of Sawmill Headrigs, by D. S. Smith.

The Economics of Flood Disasters, by J. B. Carswell, M.E.I.C.

Modern Pioneers, by N. R. Crump, M.E.I.C.

Mackenzie King Bridge, Ottawa, by V. S. Thompson, M.E.I.C., and J. E. Bright, M.E.I.C.

Another Step Toward Canadian Self-Sufficiency, by E. F. Tabisz.

The December issue will also include the Annual Index.

Elections and Transfers

At the meeting of Council held at Headquarters on Friday, October 10th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissoins Committee the following elections and transfers were effected:

Members:

A. B. Barnes, *Brockville*
J. Baskin, *Toronto*
W. Bruce, *Montreal*
J. A. Campbell, *Montreal*
T. J. Carbone, *Timmins*
J. G. Chalmers, *Bathurst*
H. V. Evans, *Bathurst*
D. A. Foster, *London*
R. G. Frederick, *Port Hope*
W. G. Goodeve, *London*
S. J. Gore, *North Bay*
T. F. Hadwin, *W. Vancouver*
W. P. Harland, *Montreal*
D. M. Jenkins, *London*
E. A. Leja, *Corner Brook*
J. Loynd, *Kapuskasing*
H. E. Martin, *London*
A. T. McKerrall, *North Bay*
R. D. McRoberts, *Kapuskasing*
V. Nakonechny, *Montreal*
W. Nield, *Montreal*
V. Niilend, *Montreal*
W. J. Reynolds, *Esquimalt*
R. G. Smalley, *Vancouver*
W. Swann, *Kapuskasing*
I. E. Szasz, *Montreal*
E. A. Watson, *North Bay*

Juniors:

D. L. Birch, *Montreal*
B. J. Clarke, *Montreal*
R. C. Cook, *Montreal*
P. Foody, *Montreal*
J. B. Frederick, *Kapuskasing*
R. Goulard, *Montreal*
D. C. Kinley, *Shawinigan Falls*
R. A. F. Latham, *Buckingham*
G. A. McDowell, *Hamilton*
R. G. Serneels, *Windsor*
T. J. G. Simms, *Ottawa*
J. I. Waldman, *Montreal*
D. Zavitzianos, *Montreal*

Transferred from the class of Junior to that of Member:

J. F. Dewson, *Bell, Calif.*
A. W. Falk, *Vauxhall, Alta.*
H. R. Kivisild, *Montreal*
L. G. Mustill, *Shawinigan Falls*
J. D. Orr, *Toronto*
M. F. Rodman, *Montreal*
H. L. Saunders, *Arvida*
P. Villemure, *Grand'Mere*

Transferred to the class of Student to that of Junior:

G. S. Bowes, *Brantford*
Y. Shing Tai, *Montreal*

The following Students were admitted:

R. A. Ackerman, *Hamilton*
P. E. Beaulieu, *Sherbrooke*
A. F. Campbell, *Hamilton*
H. I. Chmara, *Fort Erie*
J. A. Chointere, *East Lansing*
L. Dignard, *Fredericton*
R. L. Frederick, *Winnipeg*
G. A. Hearnden, *Kingston*
G. R. Fanjoy, *Kingston*
A. J. Male, *Hamilton*
W. H. McKee, *Kingston*
R. N. Outhouse, *Halifax*
K. S. Preston, *Fredericton*
J. L. Richardson, *Toronto*
S. H. Simmonds, *Edmonton*
D. Sims, *Edmonton*
D. C. Wilson, *London*

Applications Through Associations

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

ALBERTA

Members:

J. M. Daley
D. R. Stanley

SASKATCHEWAN

Members:

W. F. Dix
R. H. B. Johnson
N. W. Krug
B. C. Laws
N. W. Martison
G. H. MacDonald
J. R. Macdonald
J. E. Stobart

Junior to Member:

N. Daviduk
G. L. Drackett
H. W. Hilsden
H. E. Mahood
J. M. Wise

NOVA SCOTIA

Member:

P. M. Tomney

Junior to Member:

J. D. Wilson

Professional Development Program

EDITOR'S NOTE:

The Professional Development Program, initiated last year by the Hamilton Branch and consisting of 24 lectures and discussions on general subjects, has been expanded this year to permit further opportunities and larger participation.

Arranged in three groups, A, B and C, and intended for an approximate enrolment of 90 members, the lectures and discussions started Wednesday, September 24.

Group A, open to Student and Junior members, offers an introductory course of 24 lectures similar to that given in 1951-52. Group B, planned for Juniors and Members or graduates of the 1951-52 series, is an advanced course on five selected subjects; while Group C operates in several sections, each specializing in one broad subject.

The 1951-52 outline of the 24-point program, below, gives some indication of the variety of subjects to be made available in the 1952-53 Group A series, though the speakers and the order of the lectures would vary this year. Groups B and C, on the other hand, are being presented on the dates specified.

A recent report from Hamilton indicates that the Program has met with an excellent reception. There is not sufficient accommodation for those wanting to participate.

Group A — 1951-52

24 Point Program

1951

Sept. 27 REGISTRATION AND INTRODUCTION, L. F. Grant—Field Secretary, E.I.C.

Oct. 4 CANADIAN ECONOMIC SITUATION, Stuart Armour—Economic Advisor to the President, Steel Co. of Canada.

Oct. 11 VOCAL EXPRESSION, Miss A. Gregg.

Oct. 25 INDUSTRIAL RELATIONS: (a) PUBLIC ADMINISTRATION'S POINT OF VIEW, W. Dunn—Conciliator, Dept. of Labour, Province of Ontario.

Nov. 1 (b) LABOUR'S POINT OF VIEW, Allan Histed—President, Hamilton Trades and Labour Council.

Nov. 8 (c) MANAGEMENT POINT OF VIEW, E. R. Complin—Industrial Relation Manager, C-I-L.

Nov. 29 LETTER AND REPORT WRITING, A. Fisher—General Superintendent, Steel Co. of Canada.

Dec. 6 INTERNATIONAL RELATION, E. T. Salmon—Professor of History, McMaster University.

Dec. 20 CITIZENSHIP AND PROFESSIONAL OBLIGATIONS OF AN ENGINEER, L. F. Grant—Field Secretary, E.I.C.

1952

Jan. 3 INDUSTRIAL MANAGEMENT: (a) THEORY OF MANAGEMENT, W. J. W. Reid—President, Otis Elevator Co.

Jan. 10 (b) PRODUCTION, C. S. Finkle—Works Manager, Studebaker Corporation of Canada.

Jan. 24 ART OF SPEAKING: 2 Minute Off-the-Cuff Speeches by Members.

Jan. 31 INVESTMENT POLICY FOR THE INDIVIDUAL, J. W. Armstrong, Investment Broker, McLeod, Young, Weir & Co.

Feb. 7 CANADIAN POLITICS—FORUM, Al. Cadeau—President, Southern Ontario Liberal Association; J. McNie—Past President, Ontario Junior Progressive Conservative Association.

Feb. 28 ENGINEERING LAW—PATENTS, C. E. Church—Patent Attorney.

Mar. 6 LAW: CORPORATION STRUCTURE, R. Shea—Attorney.

Mar. 13 CHAIRMANSHIP AND RULES OF PROCEDURE, George L. Schneider, Consulting Engineer, C. C. Parker & Associates.

Mar. 20 CANADIAN CULTURE (Massey Report), Miss Freda Waldon, Chief Librarian, Hamilton Public Library.

Mar. 28 CIVIL DEFENCE, J. F. Wallace, Staff Officer Training, Civil Defence Headquarters.

April 3 SOCIAL GRACES, Mrs. Edgar Bates—Dean of Women, McMaster University.

April 10 INDUSTRIAL PSYCHOLOGY, R. A. Wilson, Personnel Manager, Studebaker Corporation of Canada.

April 24 PERSONAL FINANCE, S. L. Wellwood, Asst. Manager, Bank of Montreal.

May 1 SELF-SELLING SALESMANSHIP, R. Burgess, Sales Mgr., Electrical Housewares, Westinghouse.
May 7 CORPORATION FINANCE, A. G. Wright, Vice-President, Dominion Foundries & Steel.

Group B — 1952-53

The course is divided into five principal parts, and each section is completed with a discussion period. In this manner it is hoped that sufficient information will be provided to permit each member to participate in the proceedings and formulate his own opinion.

Part A—Civic Administration:

Oct. 1 Duties of Civic Officials.
Oct. 8 The Elected Type of City Government.
Oct. 15 City Manager Type of City Government.
Oct. 22 An Analysis of the Various Types of City Government.
Oct. 22 Discussion.
Nov. 5 Music Appreciation.

Part B—Industrial Engineering:

Nov. 12 Economic Importance and Principles of Organization.
Nov. 19 Job Evaluation and Personnel Evaluation.
Nov. 26 Office Management and Standard Costs.
Dec. 3 Industrial Psychology and Labour Relations.
Dec. 10 Discussion.
Dec. 17 Appreciation of Paintings.

Part C—Atomic Energy:

Jan. 7 Industrial Application.
Jan. 14 Medical Application.
Jan. 21 Protection in Case of War.
Jan. 28 Future Development and Uses.
Feb. 4 Discussion.
Feb. 11 Appreciation of Operas.

Part D—A Comparison of the Government of Canada and the U.S.A.:

Feb. 18 Canadian Government Organization.
Feb. 25 U.S. Government Organization.
Mar. 4 Influence of the U.S. on World Affairs.
Mar. 11 The Future of Canada.
Mar. 18 Discussion.
Mar. 25 The Engineers' Place.
April 1 Where Do We Go from Here?

Group C — 1952-53

The subject material as outlined below will be arranged and presented in turn by the individuals in the group. One or two qualified speakers will address the group on each of the sub-topics. Discussion periods will play an important part in the operation of the group. Since the groups are limited in size, each member will have ample chance to voice his questions and express his views. Debates will also be held on some of the more controversial subjects.

It is felt that the course, presented in this way, will cover the subject material in fair depth and that it will aid in the Professional Development of the individual group members since each of them will be required to play an active part in the successful operation of the group.

I. INDUSTRIAL RELATIONS

1. Ontario Labor Laws.
2. Labor Organizations; their history and structure.
3. Company Organization.
4. Labor-management relations reciprocal policies; personnel relations.
5. Industrial psychology.
6. Public relations policies of management and labor.

II. BUSINESS MANAGEMENT

1. Capital structure and financing.
2. Financial control and expansion.
3. Advertising and marketing.
4. Production.
5. Industrial relations and public relations.

III. INVESTMENT AND FINANCE

1. History of the corporate concept; capital structure and corporate securities.
2. Corporation law.
3. Methods of financing; securing new and additional capital.
4. Internal financial control.
5. Stock market analysis.

News of Other Societies

A.S.M.E. 1952 Annual Meeting, New York
November 30—December 5

A very full program has been announced by the **American Society of Mechanical Engineers** in connection with their 1952 annual meeting, which will be held in the Statler and McAlpin Hotels in New York City from November 30 to December 5, inclusive.

The theme of this meeting is to be —"Building for the Future of America." As usual, a wide variety of subjects will be dealt with, but space does not permit of our publishing the complete program. Particulars can, however, be furnished upon request, and members of the Engineering Institute are reminded that they are exempt from payment of registration fees when attending these meetings.

Some 400 members of the Canadian General Electric Company's **Test Alumni Association** attended the 24th annual Test Reunion at Peterborough, on September 13th.

Features of the day's program were a dinner in the Peterborough Works cafeteria, sports, and buffet supper.

Executive of the Association for 1952-53 consists of: the honorary president, L. D. W. Magie; president, I. M. MacLean; vice-presidents, A. R. Jones, W. H. Prevey, H. J. MacTavish, and R. C. Hardie; secretary-treasurer, F. C. Dohaney.

Changes have been made in the dates of 1953 division meetings of the **Canadian Electrical Association**, mentioned in the September *Journal*. The meetings are now scheduled as follows: Eastern Zone: Engineering division, January 15, 16, Halifax, N.S.; Sales Division, Jan. 22, 23, Niagara Falls, Ont.; General Division, Jan. 29, 30, Mont Tremblant, Que. Western Zone: Engineering Division, Feb. 23-25, Calgary, Alta; Sales and General Division, Mar. 2-3, Edmonton, Alta.

The sixteenth Wright Brothers Lecture presented by the **Institute of Aeronautical Sciences**, (2 East 64th St., New York 21, N.Y.) will take place at 3 p.m. on December 17, in the U.S. Chamber of Commerce Building Auditorium, Washington, D.C.

The **American Society of Civil Engineers** (33 West 39th St., New York 18, N.Y.) has announced the election of Walter L. Huber of San Francisco as president.

Mr. Huber, who succeeds Col. Carlton S. Proctor, of New York, has had a distinguished career of engineering important hydraulic and structural projects.

Two new vice-presidents named for 2 years, and inducted at the business meeting of October 15, with Mr. Huber, are: Edmund Friedman, of Coral Gables; and G. Brooks Earnest, Cleveland.

The **National Association of Corrosion Engineers** (1061 M. & M. Building, Houston 2, Texas) has announced that the 1953 Chicago Conference, March 16-20, 1953, will include educational lectures, symposia, and round table discussions on corrosion fundamentals and problems.

The **American Welding Society** (33 West 39th St., New York 18, N.Y.) has elected Fred L. Plummer, as its president for 1952-53. Mr. Plummer, director of engineering, Hammond Iron Works, Warren, Pa., took office as president of the Society at the annual meeting in October.

The twentieth National Exposition of Power and Mechanical Engineering will take place at Grand Central Palace, New York, December 1 to 6. The show is being held under the auspices of the **American Society of Mechanical Engineers**, at the time of the Society's annual meeting.

The annual meeting of the **American Institute of Chemical Engineers** (120 East 41st Street, New York, N.Y.) will take place at Cleveland, Ohio, December 7-10, 1952, at the Hotel Cleveland and Carter Hotel.

A meeting of A.I.Ch.E., in Toronto, Ontario, at the Royal York Hotel, April 26-29, 1953, will be a joint meeting with the **Chemical Institute of Canada.**

In connection with the plant maintenance conference and plant maintenance show, in Cleveland, Ohio, January 19-22, 1953, information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

The **Society of Naval Architects and Marine Engineers** (29 West 39th Street, New York) has announced the formation of its tenth regional section. Known as the Eastern Canadian Section, its headquarters will be in Montreal.

Chairman of the new section is Richard Lowery, vice-president of Canada Steamship Lines, Montreal. Other officers are: vice-chairman, James P. Pollock, chief draughtsman, Canadian Vickers Ltd., Montreal; secretary-treasurer, C. S. Allin, manager and secretary-treasurer, the Andros Shipping Co. Ltd., Montreal and members of the executive committee, Thomas M. Hall, president, T. M. Hall, Ltd., Montreal; J. Gordon German, naval architect Milne, Gilmore & German, Montreal; and Charles S. Smith, principal surveyor, American Bureau of Shipping, Montreal.

In November 1949 a symposium of papers covering research on magnetic materials was presented by the measurements section of the **Institution of Electrical Engineers** (England). A complementary symposium dealing with the selection and use of dielectrics in electrical engineering has now been arranged and will be held in the Institution building (Savoy Place, London W.C. 2), March 16-18, 1953, when about fifty papers will be presented.

Members of the Engineering Institute are invited to be present, and are asked to advise Headquarters of their intentions to attend.

The **British Standards Institution** has announced the appointment of Mr. T. R. B. Sanders, C.B., as engineering adviser to the Institution.

Mr. Sanders will be concerned with the current A.B.C. program for the unification of engineering standards. Subsequently his interest will extend to the whole of B.S.I.'s work in the engineering field.

Personals

News of the Personal Activities of Members of the Institute

Col. C. R. Boehm, M.B.E., C.D., M.E.I.C., has relinquished his position as director of electrical and mechanical engineering, Army Headquarters, Ottawa, to attend the 1952-53 course at the National Defence College, Kingston.

Col. Boehm was graduated from the University of Toronto in 1929 and before the war was employed as mining engineer in northern Ontario and Quebec.

Col. Boehm was commissioned in the R.C.O.C. at the beginning of the war and held the rank of major by April, 1942, when he was attached to the British Forces in North Africa. Upon his return to the Canadian Army, he was promoted to lieutenant-colonel and served at the First Canadian Army headquarters in the United Kingdom, France, Belgium, Holland and Germany, until his return to Canada in 1945. He served as deputy director of

Col. J. R. Dunlop, M.E.I.C.

the Directorate of Mechanical Engineering until his appointment as director in October, 1948. In May, 1951, the Directorate was renamed the Directorate of Electrical and Mechanical Engineering, and Col. Boehm continued as director until his departure in September, 1952.

Col. J. R. Dunlop, O.B.E., E.D., M.E.I.C., was recently promoted to the rank of colonel, and succeeds Col. C. R. Boehm, M.B.E., C.D., as director of electrical and mechanical engineering at Army Headquarters, Ottawa, and the head of the R.C.E.M.E. Corps.

Col. Dunlop is an engineering graduate of McGill University, and before the

Col. C. R. Boehm, M.E.I.C.

war, was employed as mechanical engineer with the Canadian International Paper Company.

He started his service career as an ordinary seaman in the R.C.N.V.R. Following his university studies, he was commissioned in the N.P.A.M. Signals and was mobilized with R.C.O.C. in October, 1939. After service in the United Kingdom, including the F.A.E. course at the Military College of Science, he was District O.M.E. at Kingston before returning to England with the First Canadian Base Ordnance Workshop in March 1942. In 1944, he took the Tenth Canadian Infantry Brigade Workshop to France as its O.C. with the rank of major. By November, 1945, when he returned to Canada, he was C.R.E.M.E. (lieutenant-colonel) of the Second Canadian Infantry Division. After three years with the Directorate of Mechanical Engineering at Army Headquarters, he attended the Canadian Army Staff College. On the completion of a year's study, he was appointed O.C. of the R.C.E.M.E. School at Kingston in December, 1949.

Col. W. A. Capelle, M.E.I.C., has been appointed director of works, in the Q.M.G. Branch, at Army Headquarters, Ottawa. He was previously command engineer at Central Command Headquarters.

He received his B.Sc. degree in civil engineering from the University of Manitoba in 1932, after which he joined the

Col. W. A. Capelle, M.E.I.C.

R.C.E. as a second lieutenant, N.P.A.M. He was commanding the 7th Army Troops Company in Winnipeg at the outbreak of war. In September 1939 he assumed command of 1st Corps Field Park Company in Winnipeg, which he took overseas.

This was followed by command and regimental appointments, and in November 1944 he became staff officer Royal Engineers Airfields at the First Canadian Army Headquarters.

Returning to Canada in 1945 he retired from the Active Force. He was taken on strength of the Active Force in 1947, posted to the Directorate of Works and Accommodation as assistant director in the branch of the Quartermaster General, Army Headquarters, and being appointed director in 1949. In November 1950 he was appointed command engineer, Central Command. His promotion to rank of coloned and his appointment as director of works was announced in August, 1952.

A. J. Groleau, M.E.I.C.

A. J. Groleau, M.E.I.C., has been appointed chief engineer in the special projects organization of the Bell Telephone Company.

A graduate in 1927 from McGill University, Mr. Groleau joined the Bell Telephone Company in 1928 as a student engineer He has held various engineering posts with the company and since February, 1951, he has been chief engineer of the company's eastern area comprising the province of Quebec and part of eastern Ontario.

J. F. Mills, M.E.I.C., is now vice-president of Siemens Brothers (Canada) Limited, Winnipeg.

J. F. Mills, M.E.I.C.

Mr. Mills was associated with the Manitoba Telephone System since 1936. He was appointed chief engineer in 1945 and in addition to this position, he became assistant general manager in 1948.

Before joining the Manitoba Telephone System, Mr. Mills was with Siemens Brothers (Canada) Limited from 1926, and during the period 1930-1931, took a special telecommunication engineering course in the company's main factory in London, England.

P. J. Farmer, M.E.I.C., has been transferred to Toronto by the English Electric Company of Canada Limited as district manager. Mr. Farmer was previously the company's district manager in Winnipeg.

He is a graduate electrical engineer from the University of British Columbia, 1939.

L. S. McGregor, M.E.I.C., now holds the position of superintendent of motive power and car equipment for the northern Ontario district of the Canadian National Railways and is located in North Bay, Ont. Previous to this appointment he was mechanical engineer in the company's central division in Toronto.

Mr. McGregor was graduated from McGill University in mechanical engineering in 1936.

Brig. M. Archer, M.E.I.C., has been appointed vice-chairman of the National Harbours Board, Ottawa.

He was a partner in the consulting engineering firm of Archer and Dufresne, Quebec, for many years. He graduated in civil engineering from McGill University in 1933.

D. D. Reeve, M.E.I.C., recently joined the staff of the Pacific Coast Pipe Co. Ltd., Vancouver, as development engineer.

Mr. Reeve an engineering consultant for the past two years in Vancouver, previously held engineering positions in several western and eastern pulp and paper mills and in the aluminum industry.

D. D. Reeve, M.E.I.C.

He was graduated from the University of British Columbia in mechanical engineering in 1933.

He is a member of the Association of Professional Engineers of Manitoba.

Maj. H. Goodfellow, M.B.E., M.E.I.C., has completed his tour of duty as technical staff officer with the 26th Canadian Infantry Brigade in Korea, and has returned to his original station with the Canadian Army Operational Research Establishment at the Royal Military College in Kingston.

Major Goodfellow received his mechanical engineering degree from the University of Saskatchewan in 1940. He immediately joined the Royal Canadian Engineers and returned from overseas duty in 1946. At that time he was appointed district electrical and mechanical engineer for District No. 10, Winnipeg. In 1948 he was appointed deputy assistant adjutant general in the Directorate of Army Personnel and was assigned to his present post in 1950.

P. C. Kirkpatrick, M.E.I.C., has joined the engineering department of the Atlas Construction Co., Ltd. in Montreal.

Mr. Kirkpatrick has been associated for years with Fraser Brace Engineering Ltd., Montreal, as resident engineer. He has also worked as resident engineer on projects for H. G. Acres & Company.

C. H. Cook, M.E.I.C., has recently become associated with Kearns and Bromley, consulting engineers in Montreal. He has been in consulting engineering in Montreal for several years.

He was previously with Canadian Domestic Engineering Co. in Montreal and with Defence Industries Ltd.

Mr. Cook is a graduate of the University of Manitoba, receiving his degree in electrical engineering in 1940.

Lt. R. A. Grosskurth, R.C.N., M.E.I.C., has been named assistant command electrical officer on the staff of Rear Admiral R. E. S. Bidwell, flag officer, Atlantic Coast.

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Before this appointment he was electronics instructor in H.M.C. Electrical School, H.M.C.S. Stadacona in Halifax.

R. W. Lister, M.E.I.C., has been promoted to the position of district sales manager of the Niagara district of the Canadian Westinghouse Co., Ltd. in Hamilton. Mr. Lister was previously sales engineer.

He is a 1947 B.A.Sc. graduate of the University of British Columbia.

R. F. E. Bunston, M.E.I.C., heads Bunston Ltd., of Vancouver and Winnipeg, the new firm recently appointed Western Canada sales representatives for Burndy Canada Limited.

A 1942 Queen's University graduate, Mr. Bunston served as electrical officer in the Royal Canadian Navy during the war and joined Burndy Canada Limited as field engineer in 1947. Two years later he was appointed chief sales engineer when the company established its Canadian plant. In 1951 he became chief engineer and was placed in complete charge of plant and production including design and quality control.

R. F. E. Bunston, M.E.I.C.

F. H. Fargey, M.E.I.C., has been transferred by the Brown Boveri (Canada) Limited from Montreal to Toronto as Ontario Branch manager.

Mr. Fargey is an electrical engineer, graduated from the University of Manitoba in 1934. He was a sales engineer for the Company, in Montreal, previously.

H. F. Peters, M.E.I.C., has been transferred by the Department of Resources and Development from Brandon, Man., to Port Arthur, Ont. Mr. Peters is inspecting engineer for the Trans-Canada Highway Division.

C. H. Lusk, M.E.I.C., who has been with the Hydro-Electric Power Commission of Ontario since 1948, is now consumer service superintendent at Belleville, Ont.

Mr. Lusk is a graduate engineer from the University of Toronto where he received his degree in 1947.

He is secretary-treasurer of the Belleville Banch of the Engineering Institute.

J. L. Allen, M.E.I.C., has accepted the position of project engineer with the Dominion Tar and Chemical Company, Montreal.

He is a 1943 McGill University mechanical engineering graduate and was previously associated with the Canadian Johns-Manville Company in Asbestos.

C. L. F. Cooper, M.E.I.C., is now project engineer with the Central Mortgage and Housing Corp., Construction Division, Trenton, Ont.

Mr. Cooper was formerly resident construction engineer with the Water Works department of the city of Hamilton.

Major Malcolm Turner, R.C.E., M.E.I.C., who has been deputy command engineer, Canadian Army, in Halifax has been transferred to Chiliwack, B.C., to command a field squadron, R.C.E.

Gerard Lefebvre, M.E.I.C., has joined Ayers Limited, Lachute, Que., as production engineer and controller.

Mr. Lefebvre was formerly associated with Dufresne, McLagan and Associates, industrial consultants in Montreal, and with the Dominion Rubber Company Limited as superintendent of the company's St. Jerome branch.

He is a graduate of Ecole Polytechnique, Montreal, where he received his B.A.Sc. degree in 1942.

J. S. Francis, M.E.I.C., is now associated as sales engineer with T. C. Chown Limited, Montreal.

Mr. Francis was previously with Electric Tamper and Equipment Co. of Canada Ltd. in Montreal.

He is a 1943 graduate in electrical engineering from the University of Manitoba.

D. Collis, M.E.I.C., has been appointed division engineer for the Canadian Pacific Railway Company in Montreal.

Prior to his appointment Mr. Collis was located in North Bay as assistant district engineer, Algoma District. He was earlier with the Dominion Atlantic Railway with headquarters in Kentville, N.S., and with the Canadian Pacific Railway Company in Saint John, N.B.

J. H. Hargrave, M.E.I.C., is now associated as design engineer with E. & B. Cowan, consulting engineers in Montreal.

A graduate in civil engineering from the University of Alberta in 1941, Mr. Hargrave was previously with the C. D. Howe Company Limited in Port Arthur, Ont.

H. Spector, M.E.I.C., is at present on the staff of the Naugatuck Chemical, a division of the United States Rubber Company. He is engaged in research work on latices for application to the pulp and paper industry.

Mr. Spencer is a 1944 chemical engineering graduate from the University of Saskatchewan, and was previously employed as assistant to the technical director of the St. Regis Paper Company, Watertown, N.Y.

T. C. Powell, M.E.I.C., has been transferred from the Toronto sales engineering office of the Canadian Johns-Manville Co., Ltd. to the Montreal office of that company.

Previous to his association with the Canadian Johns-Manville Company, Mr. Powell was on the staff of the C.I.L.'s Nylon Division at Kingston.

He is a graduate of the University of Toronto where he received his B.A.Sc. degree in 1938.

E. J. MacLeod, M.E.I.C., has accepted the position of assistant transmission and distribution engineer with the Calgary Power Limited. He was previously associated with the Maritime Electric Company Limited in Charlottetown. He was associated earlier with Calgary Power Limited as assistant engineer.

Mr. MacLeod received his electrical engineering degree from the University of Alberta in 1939.

Maj. R. C. Lane, M.E.I.C., has returned to Canada following a one-year tour of duty in Korea and has been appointed Canadian liaison officer at the Detroit Arsenal.

During the war Major Lane was with the 6th Armoured Regiment (1st Hussars) at Camp Borden and overseas; later he was stationed at Army Headquarters in Ottawa with the Directorate of Weapons and Development and at Eastern Ontario headquarters, Kingston.

W. Rothwell, M.E.I.C., has recently accepted the position of chief engineer with the T.C.F. of Canada Limited in Cornwall, Ont.

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Mr. Rothwell graduated in engineering from London University, England in 1938. He was in textile work in England until 1942, finally as plant engineer for Edward Ripley & Son Ltd., at Bradford. He served for three years with the R.E.M.E., and in 1949 he went to Alexandria, Egypt, as chief engineer of Beida Dyers, a branch of Bradford Dyers Association. He worked for Ferguson Bros., Ltd., Carlisle, England, from 1947 to 1949, as works engineer.

In Canada since 1949, he has worked with Montreal Cottons Ltd., Valleyfield, Que., as assistant mechanical superintendent.

B. A. Lawrence, M.E.I.C., has been transferred by the Nance Exploration Company from The Pas, Man., to Calgary.

Mr. Lawrence received his civil engineering degree fom the University of Saskatchewan in 1945.

W. J. Hardstaff, M.E.I.C., is now sales engineer in the propane division of the Royalite Oil Company Limited in Calgary. He was previously associated with this company in Kindersley, Sask.

Mr. Hardstaff is a graduate in civil engineering from the University of Saskatchewan.

D. R. Abbey, JR.E.I.C., is presently employed as chemical engineer with Underwriters Laboratories of Canada Limited in Toronto. He was formerly associated with Stone and Webster (Canada) Limited of Toronto on the Canadian Oil Refineries project at Froomfield, Ont.

Following graduation from the University of Saskatchewan in 1945 and post-graduate work at McGill University, Mr. Abbey was employed as field office manager at Senneterre, Que., for Surveyor, Nenniger and Chenevert, Montreal.

Thos. M. Thomson, JR.E.I.C., is now associated with the Ash River division of MacMillan & Bloedel Ltd., Port Alberni, B.C. He was previously resident engineer with the Kennedy Lake Log Co. Ltd., of Ucluelet, B.C.

Mr. Thomson received his forest engineering degree from the University of British Columbia in 1947.

J. W. Black, JR.E.I.C., has relinquished his position with the National Research Council to become officer in the Directorate of Vehicle Development at Army Headquarters, Ottawa.

A. G. Gentle, JR.E.I.C., is now associated with the Atomic Energy of Canada Limited as development engineer. He was formerly with the Eldorado Mining and Refining Ltd.

A. W. Laurie, JR.E.I.C., is associated with the plastics division of the Monsanto Chemical Company in Springfield, Mass.

He is a graduate of Laval University, receiving his engineering degree in 1948.

B. St. C. Langille, JR.E.I.C., is now leading draughtsman and designer in charge of the section on design of Dosco Continuous Miner for the Dominion Steel and Coal Corp. in Sydney, N.S. He was graduated from the Nova Scotia Technical College, receiving his mechanical engineering degree in 1950. Mr. Langille joined the Dominion Steel and Coal Corp. as a junior engineer.

Frank Black, JR.E.I.C., is manager in charge of engineering supplies and re-

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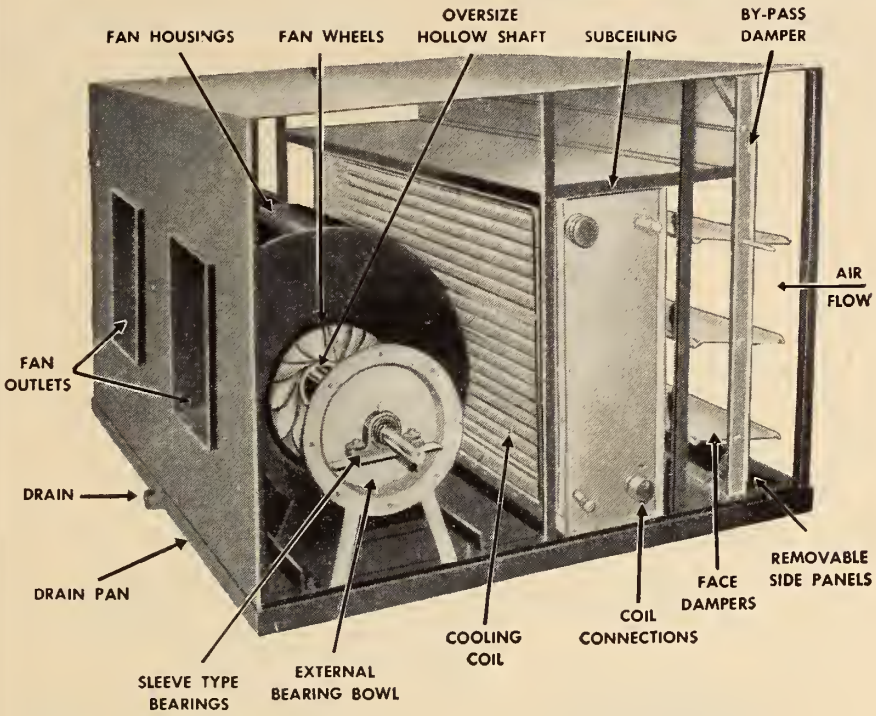

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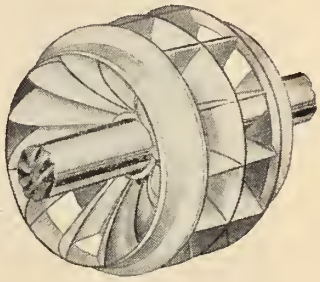

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Mr. Black received his degree in electrical engineering in 1946 from the University of Alberta, and was previously employed as junior engineer with the Schlumberger Well Surveying Corp. in Calgary.

J. M. McLaughlin, JT.E.I.C., is now associated as design engineer with the Dow Chemical Company in Sarnia.

A graduate in mechanical engineering in 1949 from the University of Toronto, Mr. McLaughlin was formerly employed by E. Leonard & Sons of London, Ont.

C. E. Scott, JT.E.I.C., has been transferred by Canadian Industries Ltd. to the company's Maitland works in Maitland, Ont. Until his transfer Mr. Scott was engaged in the nylon intermediates project in Montreal. He will serve as technical trainer on nylon intermediates in Maitland.

Following his graduation in chemical engineering from the University of Toronto in 1947, Mr. Scott was employed in the development section of the technical department of Consolidated Works, Shawinigan Falls, Que.

D. S. Cameron, JT.E.I.C., has joined the staff of the Johns-Manville Company, Asbestos, Que. He is a 1949 graduate in civil engineering from the University of Saskatchewan, and was previously employed as assistant engineer with the Canadian National Railways maintenance engineering division in Montreal.

Wm. G. Mayberry, JT.E.I.C., has recently been transferred to the eastern district sales office of Canadian Allis-Chalmers (1951) Ltd. in Montreal from the head office in Lachine, Que., where he has specialized in pumps and feeders for the pulp and paper industry.

Wm. G. Mayberry, M.E.I.C.

Mr. Mayberry is a 1947 mechanical engineering graduate of the University of Toronto.

Alex Smerek, JT.E.I.C., is now assistant district engineer with Central Mortgage and Housing Corporation in Edmonton.

A 1950 graduate in civil engineering from the University of Alberta, Mr. Smerek was previously construction supervisor in the Department of Public Works, Lethbridge.

D. G. B. Anderson, JT.E.I.C., is now on the staff of Defence Industries (1951) Limited as project engineer in Valleyfield, Que.

Previous to this appointment Mr. Anderson was associated with Lever Bros. Limited, Toronto. He is a 1950 B.A.Sc. graduate of the University of Toronto.

Gerard Ennis, JT.E.I.C., has joined the Northern Electric Co. Ltd. in Montreal. He received his electrical engineering degree from McGill University, graduating in 1950.

J. G. Lavergne, JT.E.I.C., is with M. W. Kellogg Company, New York as design engineer of the plant section of the company's vessel division.

He was previously employed as design engineer at the Montreal refinery of the Shell Oil Company of Canada. Mr. Lavergne is a 1950 engineering graduate of the University of Toronto.

D. A. deWolff, JT.E.I.C., has joined Structural Engineering Services Limited, Calgary, as design engineer.

A graduate in civil engineering in 1950 from the University of Alberta, Mr. deWolff was previously employed by the Department of Buildings and Maintenance of the University of Alberta.

C. E. Leonoff, JT.E.I.C., received his M.Sc. degree in civil engineering from the University of Washington this year and has joined Ripley & Associates, consulting engineers in Vancouver, as soil engineer.

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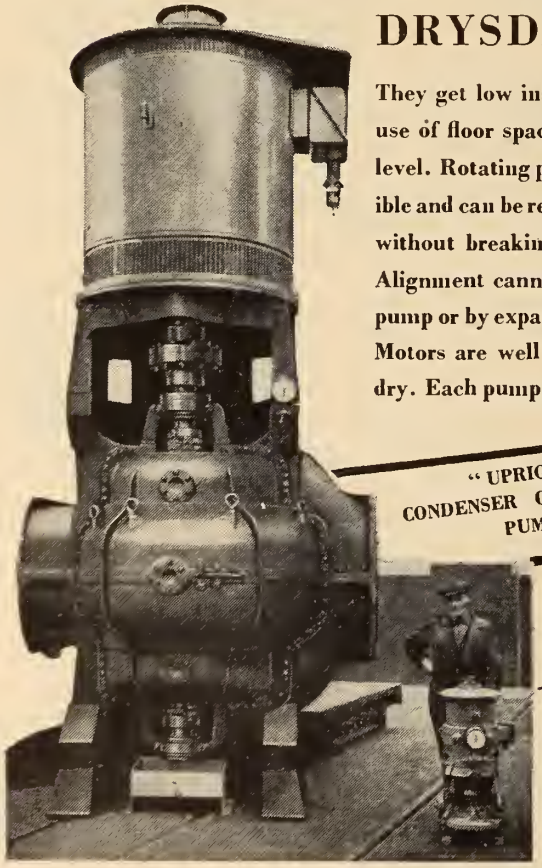

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Mr. Leonoff obtained his B.Sc. degree in civil engineering from the University of Manitoba in 1949.

J. W. Dewson, JR.E.I.C., is design engineer with the Consolidated Western Steel Corp. in Los Angeles. Previous to this appointment he was with the Capital Engineering Corp., Dillsburg, Pa.

Mr. Dewson is a 1950 graduate in civil engineering from the University of Saskatchewan.

M. G. Spankie, JR.E.I.C., has joined Engineers J. P. Keith & Associates, consulting engineers in Montreal. He was previously employed as electrical assistant in the office of the chief architect of the Canadian National Railways in Montreal.

Mr. Spankie was graduated in electrical engineering in 1950 from McGill University.

J. B. Herbich, JR.E.I.C., has been transferred by the Aluminum Company of Canada Limited from Peribonka No. 1 Power Development at Chute du Diable, Que., where he was in charge of the central concrete laboratory, to Kitimat, B.C. He is here engaged as engineer in charge of design, inspection and testing of concrete for the company's Kitimat project.

Mr. Herbich obtained his civil engineering degree from the University of Edinburgh in 1949.

J. B. Herbich, Jr., M.E.I.C.

R. G. Redman, JR.E.I.C., has joined E. B. Magee Ltd. in Port Colborne, Ont., as office engineer. He was formerly product design engineer for the R. D. Werber Co. Ltd. in Oshawa, Ont.

Mr. Redman is a 1949 graduate of the University of Toronto.

J. S. Busby, JR.E.I.C., has accepted a transfer to Cochrane, Ont., as assistant junior engineer with the Canadian National Railways. He comes to Cochrane from Quebec City where he served as instrumentman in the company's engineering department.

Mr. Busby was graduated with a civil engineering degree from the University of New Brunswick in 1948.

F. L. Morton, JR.E.I.C., is now with the Manitoba Paper Co. Ltd., Pine Falls, Man. A graduate in civil engineering in 1947 from the University of Manitoba, Mr. Morton was previously employed as junior engineer with the Water Works Branch for the City of Winnipeg.

David Townsend, JR.E.I.C., will return to McGill University this year to undertake research work there for the Defence Research Board. Recently employed by the Ontario Paper Company, Mr. Townsend received his degree in civil engineering from McGill University in 1948.

Capt. B. Yarymowich, JR.E.I.C., has been appointed adjutant for R.C.E.M.E. Quebec Command headquarters. He has recently completed a course on the maintenance of vehicles, small arms and artillery, as well as fire control equipment, at the Aberdeen Proving Ground in Maryland.

Capt. Yarymowich received his B.A.Sc. degree in chemical engineering from the University of Toronto in 1949.

G. Allen Gray, JR.E.I.C., is now employed as sales engineer with the Ontario Equipment and Supply Ltd. in Ottawa. Prior to this appointment he was attached to the Canadian Ingersoll-Rand Company in Montreal in the same capacity. Mr. Gray was graduated as a mechanical engineer from Queen's University in 1949.

J. A. Sarjeant, JR.E.I.C., is on leave of absence from the Howard Smith Paper

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Company for a period of one year to work toward his M.Com. degree at the University of Toronto. He obtained his B.A.Sc. degree in engineering and business from this university in 1948.

Capt. R. Vollett, JR.E.I.C., has returned to Canada after completing the technical staff course at Shrivenham, England. He is now stationed at Valcartier, Que., where he is engaged in armament research and development.

Capt. Vollett is a chemical engineering graduate from the University of Toronto, 1949.

T. Mentel, JR.E.I.C., is a fellow in applied mathematics at Brown University, Providence, R.I. Previously he was on the staff of the National Research Council in Ottawa. Mr. Mentel is an aero engineering graduate from the University of Toronto, 1950.

J. M. Hall, JR.E.I.C., is now mechanical engineer with Canadian Johns-Manville Company in Asbestos. He was formerly on the staff of the Toronto Harbour Commission. Mr. Hall was graduated in civil engineering in 1949 from the University of Toronto.

J. B. Hyde, S.E.I.C., is on the staff of Toledo Scale Company, Windsor, having completed the training course made available by the company in Toledo, Ohio. Mr. Hyde is a 1951 graduate in engineering and business of the University of Toronto.

Benoit Plaisance, S.E.I.C., has joined the staff of the Goodyear Tire & Rubber Company at St. Malo, Que.

Mr. Plaisance is a chemical engineering graduate of Laval University, 1951.

D. R. Sherk, S.E.I.C., is now associated with the Canadian General Electric Company in Toronto.

P. M. Hunchak, S.E.I.C., has recently joined the Northern Electric Company as methods engineer. Mr. Hunchak is a graduate in mechanical engineering from the University of Saskatchewan, 1951.

W. E. Buchan, S.E.I.C., is sales and service engineer of the Hughes Tool Service Limited, Edmonton. He is a graduate this year in mechanical engineering from the University of Saskatchewan.

C. F. Gross, S.E.I.C., employed by Anglin-Norcross Ontario Ltd., on the Ford assembly plant at Oakville, Ont. He is a 1951 graduate in civil engineering from McGill University.

T. C. Hall, S.E.I.C., is on the staff of the Cockshutt Aircraft Limited, Renfrew, Ont., as electrical engineer. Mr. Hall was graduated from the University of British Columbia in 1951.

J. M. Archibald, S.E.I.C., has been associated with the National Gypsum Co. (Canada) Ltd. in Dingwall, N.S., since his graduation as mechanical engineer from the Nova Scotia Technical College this year.

I. C. McLeod, S.E.I.C., has entered the employ of the Imperial Oil Limited, Sarnia, as operations analysis engineer. He is a graduate this year of the Nova Scotia Technical College in chemical engineering.

G. H. Groves, S.E.I.C., has joined the Standard Felt Company in Pasadena, Calif., as assistant plant engineer. Mr. Groves is a graduate mechanical engineer this year from the University of Manitoba.

W. Macdonald, S.E.I.C., is a junior engineer with the Hydro-Electric Power Commission of Ontario in Toronto. He was graduated this year from the University of British Columbia.

B. F. Welsh, S.E.I.C., is now on the staff of the Department of Public Works of Canada in Toronto. Mr. Welsh obtained his B.A.Sc. degree from the University of Toronto this year.

J. J. P. Roberton, S.E.I.C., is now special assignments engineer with the Canadian Pratt & Whitney Aircraft Co. Ltd. in Longueuil, Que. Mr. Roberton was graduated last year from McGill University.

C. F. Atcheson, S.E.I.C., is associated with the Canadian Westinghouse Co. Ltd., Hamilton, as student engineer.

L. H. Olsen, S.E.I.C., has joined the Canadian Westinghouse Co. Ltd. in Hamilton as student engineer. He is a mechanical engineering graduate of this year from the University of Manitoba.

J. M. Squire, S.E.I.C., is continuing with the Athlone Fellowship. Having completed one year with the Metropolitan Vickers Electrical Company in Manchester, he is now studying thermodynamics at the University of Birmingham. Mr. Squire obtained his mechanical engineering degree from McGill University last year.

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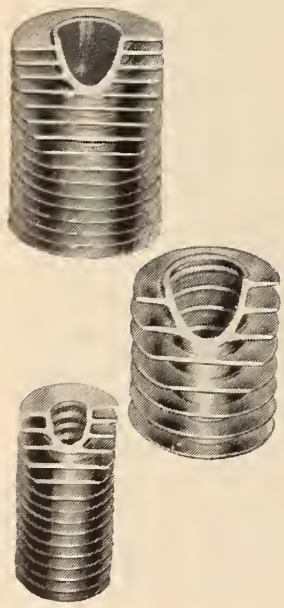

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J. S. Foster, S.E.I.C., has joined Dominion Engineering Works in Montreal as design engineer. He is a 1951 graduate in mechanical engineering from the University of British Columbia.

C. A. Crawford, S.E.I.C., is a mechanical engineer with Atomic Energy of Canada at Chalk River. He was graduated last year from the University of British Columbia.

George Gauthier, S.E.I.C., is a student engineer with the Canadian Westinghouse Company in Hamilton. He received his electrical engineering degree from the University of Alberta last year.

A. P. Foster, S.E.I.C., has joined the staff of Associated Engineering Services Ltd., consulting engineers in Edmonton. He is a graduate this year from the University of Saskatchewan.

Visitors to Headquarters

Sept. 29 **Frank P. Vaughan,** M.E.I.C., Saint John, N.B.

Sept. 29 **F. A. Crawley,** M.E.I.C., North Sydney, N.S.

Oct. 2 **V. A. McKillop,** M.E.I.C., London, Ont.

Oct. 4 **F. S. B. Heward,** M.E.I.C., Sidney, B.C.

Oct. 5 **Brig. A. B. Connelly,** M.E.I.C., Ottawa, Ont.

Oct. 8 **Richard M. Cork,** Vancouver, B.C.

Oct. 8 **A. S. Lowe,** M.E.I.C., London, England.

Oct. 9 **E. W. Dill,** M.E.I.C., Sarnia, Ont.

Oct. 10 **R. M. Richardson,** M.E.I.C., Saint John, N.B.

Oct. 17 **H. C. Fitz-James,** M.E.I.C., Vancouver, B.C.

Oct. 17 **C. C. Marshall,** London, England.

Oct. 20 **W. F. Patterson,** JT.E.I.C., Arvida, Que.

Oct. 23 **E. B. Pearson,** JT.E.I.C., Oakville, Ont.

Oct. 23 **Russell Yuille,** M.E.I.C., Saint John, N.B.

Oct. 25 **T. A. L. Paton,** London, England.

Oct. 27 **T. E. Bradshaw,** M.E.I.C., Toronto, Ont.

Oct. 27 **A. Robert Edis,** M.E.I.C., Deep River, Ont.

Oct. 25 **J. E. Smith,** Ottawa, Ont.

Oct. 28 **F. W. Gray,** M.E.I.C., Victoria, B.C.

Oct. 30 **G. E. Robinson,** London, England.

Oct. 30 **L. E. Mitchell,** M.E.I.C., Sarnia, Ont.

Obituaries

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

Louis Ernest Herve Lippe, M.E.I.C., formerly city engineer of Joliette, Que., died May 17, 1952, at the age of 74.

Mr. Lippe was born at St. Ambroise de Kildare, Que., and received his general schooling and scientific education at the Joliette Seminary, graduating in 1901.

Mr. Lippe was active for years in land surveying, and in railroad and highway construction. He became a consulting engineer in 1916 and from 1922 until 1946 he was city engineer for Joliette.

Mr. Lippe joined the Engineering Institute as a Student Member in 1905, transferring to Associate Member in 1912, and a Member in 1946.

Claude Henry Rogers, M.E.I.C., died recently in Phoenix, Arizona, where he had lived in retirement since 1944. He was formerly manager of the Peterborough Canoe Company, Peterborough, Ont.

Mr. Rogers was a graduate of the University of Toronto, where he obtained his B.A.Sc. degree in 1907. He joined the Engineering Institute that same year as a Student Member, becoming an Associate Member in 1909 and a Member in 1919.

During the first World War, Mr. Rogers served in the Canadian Army as a lieutenant in the 3rd Canadian Division. From 1915 he held the rank of captain, serving with the Canadian Engineers of the British Engineering Force. Mr. Rogers was a holder of the Military Cross.

J. M. Fairbairn, M.E.I.C., of Montreal, president of Charles Warnock and Company Ltd., died suddenly at his home on September 15, 1952.

J. M. Fairbairn, M.E.I.C.

Mr. Fairbairn was born in Ottawa, Ont., in 1903. He was educated at Wickham House School, Montreal, and at McGill University, receiving the degree of B.Sc. in mechanical engineering in 1924. He began his engineering work as an apprentice with the Steel Company of Canada, Ltd., Hamilton; after which he went as an inspection engineer to the P. and M. Company, Chicago. He was later a sales engineer for that company, but returned to Canada in 1928. Joining the Charles Warnock and Company Ltd. he was the manager at Toronto from 1928-1933. He was appointed general manager at Montreal in 1933, vice-president of the company in 1936, and president in 1948. Earlier this year he was appointed president of Construction Borings Limited, continuing to be president of Charles Warnock and Company Ltd., and a director of both companies.

Mr. Fairbairn became a Student Member of the Engineering Institute in 1921, transferring to Associate Member in 1931 and a Member in 1940. He held membership also in the Professional Engineers Associations of Quebec and Ontario; in the American Society of Testing Materials, the American Water Works Association, the Canadian Institute of Mining and Metallurgy, the American Concrete Institute, Canadian Standards Association, the American Railway Engineers Association, the American Petroleum Institute, the Canadian Gas Association, the Association of American Railroads, the Canadian Railway club, and the Canadian Gas Manufacturers Association.

Leon Galler, M.E.I.C., chief engineer and director of the Pentagon Construction Co. Ltd., Montreal, died on September 18, 1952, at the age of 61.

Mr. Galler graduated from the University of Vienna in 1917. He spent the years until 1925 as engineer in various engineering projects in Central Europe, and as owner of a construction company there.

From 1925 to 1948 he was associated with the Atlas Construction Company, Limited. As a supervising engineer for seven years, he was in charge of such projects as the underground electrical conduits in Montreal, plant construction for Montreal Waterworks, and work for the Montreal Harbour.

As general superintendent, from 1933-1942, he supervised many important projects, including the Cote des Neiges reservoir in Montreal, and the 48″ watermain project in Toronto running from Victoria Park Ave. to St. Clair Reservoir. As chief engineer from 1943-1948, he acted as consultant on or designer of many projects, including

Gander and Botwood Airports, Newfoundland, and the concrete plant and conveyor system for McConnell Lake Dam of the Ontario Hydro.

Appointed director and chief engineer of the Pentagon Construction Company, in 1948, he remained with the company. He was actively connected with hydro-electric projects for the Hydro-Electric Power Commission of Ontario, and the Aluminum Company of Canada Limited. He worked on the extension to the McTavish Pumping station in Montreal and on other important projects.

Mr. Galler joined the Engineering Institute as an Associate Member in 1927, transferring to Member in 1940.

Eric Farwell Hawley, M.E.I.C., **of Montreal,** died Tuesday, September 9, 1952, in his 47th year.

Born in Cowansville, Mr. Hawley received his general education at Feller Institute, Grande Ligne, Que. After obtaining his B.Sc. degree in electrical engineering from McGill University in 1931, he followed the Canadian General Electric Test Course, at Toronto and Peterborough.

He worked with the Lake St. Louis Bridge Corporation as an electrical engineer during the construction of the Honore Mercier Bridge in Montreal. In 1934 he was for a time maintenance engineer for the Amos division of the City Gas and Electric Corp., Ltd., in Montreal. He was then appointed electrical engineer for the Town of Amos, Que. For several years Mr. Hawley was with the English Electric Company of Canada Ltd., St. Catharines, Ont., as assistant foreman of the test department. During the years 1939-1944 Mr. Hawley was associated with airport work, as foreman-in-charge at the Megantic Intermediate Airport, as resident engineer at the R.C.A.F. Airport E.F.T.S.; and in the Air Services Branch of the Department of Transport at Montreal.

From 1944 until his last illness, Mr. Hawley was with the Northern Electric Company in Montreal and Lachine,

E. F. Hawley, M.E.I.C.

Que., latterly as supervisor in charge of the methods engineering division.

He joined the Engineering Institute as a Student in 1930 and became a Member in 1940. Mr. Hawley was a member of the Association of Professional Engineers of Quebec.

Albert Liddiard Cole, M.E.I.C., superintendent of power for the Saskatchewan Power Corporation, died very suddenly at his hotel on September 10, while on a business trip to St. Catharines, Ont.

Mr. Cole, who was in his 63rd year, was born in Blythe, Ont., and received his early schooling in Ontario. He began his engineering training with the Weston Instrument Company in Jersey City, but his interest in steam-electric power generation took him west where he became chief engineer with the light and power department of the City of Regina. He was one of the first men securing papers in Saskatchewan as a stationary steam engineer.

In 1922 he became assistant editor of "Power", a magazine of the McGraw-Hill Publishing Company in New York. He was responsible for many engineering articles on pulverized fuel, stokers, boiler furnaces and all types of power plant equipment.

He returned to Saskatchewan in 1932 to join the staff of the light and power department of the City of Regina as assistant superintendent and development engineer. In 1937 he became superintendent of power for the Commission in 1946 with responsibility for operations and development of generation for that province, a position which he held until the time of his death.

When Mr. Cole joined the Saskatoon plant in 1937 there was a 10,000 kw. turbo-generator and two 85,000-lb.-steam-per-hour boilers. At the present time plans were in hand for the increase of equipment in this station to 75,000 kw. capacity and the installation of five modern boilers with a total output of nearly 1,000,000 lbs. per hour.

Mr. Cole was also responsible for the steam stations of the Power Corporation at Estevan and Prince Albert and the natural gas-diesels at Unity. These are the major plants supplying power for the integrated system which now covers most of the Province of Saskatchewan. There are twelve other stations, including Humbolt, Yorkton, Swift Current and Wynyard.

Mr. Cole was a member of the Association of Professional Engineers of Saskatchewan, and of the American Society of Mechanical Engineers. He joined the Engineering Institute as an Associate Member in 1938 and became a Member in 1940.

A. L. Cole, M.E.I.C.

Willard Davidson Taylor, M.E.I.C., of Toronto and Port Credit, Ont., passed away early this year in Toronto in his 50th year.

Born in Ottawa, Mr. Taylor received his general education at the Ottawa Collegiate Institute. He obtained his B.Sc. degree in electrical engineering in 1927 at McGill University.

W. D. Taylor, M.E.I.C.

During his summer vacations while attending university he was employed by the Dominion Bridge Company in Ottawa.

From 1925 to 1927, Mr. Taylor followed the student training course of the Wagner Electric Corporation in St. Louis, Mo., and served in the automotive starting, lighting and ignition department on the design of this equipment.

Mr. Taylor then joined the Canadian National Railways as electrician, later working as an electrical inspector, and finally, as electrical engineer for the Central Region.

Mr. Taylor was employed from 1932 to 1947 by the Railway & Power Engineering Corporation Limited in the sales and design division, where his work included the supervision of the erection of industrial furnaces, electrical control apparatus, pyrometer equipment, and deep well pump equipment.

For the past five years Mr. Taylor has been chief electrical engineer for the Central Region of Canadian National Railways, with headquarters in Toronto.

Mr. Taylor joined the Engineering Institute as an Associate Member in 1939 and became a Member in 1940.

William Beattie Ramsay, M.E.I.C., Regina sportsman and businessman, died on September 30 at the age of 57. He had retired a few weeks earlier from sports activities.

Mr. Ramsay was born in Lumsden, Sask. He attended public school there and Central Collegiate in Regina, and in 1914 he entered the University of Toronto.

In 1915 Mr. Ramsay enlisted in the Royal Flying Corps and served in Italy with the rank of lieutenant. He returned to the University of Toronto in 1919, graduating with a B.A.Sc. degree in 1922. Mr. Ramsay's association with sports became noteworthy at university. He was captain of the Varsity hockey team in his graduating year, when the team won the Allan Cup, and he was coach of the Varsity squad the following year, while working as an instructor in the faculty of applied science.

He played with Toronto Granites in 1923. The next year the team went to Chamonix, France, for the Olympics. In 1925 he coached the Princeton University hockey team.

Mr. Ramsay played with the first Maple Leafs hockey team organized by Con Smythe in 1926-27. Both men had been associated with university hockey teams and their friendship continued down through the years.

At the end of that season Mr. Ramsay returned to Regina, starting a road contracting business with the late Archie Young of Unity, later forming his own company, Beattie Ramsay Construction Co. Ltd.

During the summers of his college years, Mr. Ramsay worked for the Saskatchewan Department of Highways.

In 1930 he settled at Lumsden. For two years 1931-33 he coached the Prince Albert Mintos.

The family moved from Lumsden to Regina in 1938. Mr. Ramsay was associated with the old Regina Aces before the Second World War. In 1946 he became president of the Regina Pats junior hockey club, a position he held until early this month.

For a number of years, Mr. Ramsay was a member of a syndicate including Ramsay, Wells and Bird to expedite operations on airport construction and other war projects with the object of combining efforts of the companies in order to produce greater volume.

When the war was over, he entered an association with Bird Construction Co. to carry out large construction jobs.

Mr. Ramsay served in many organizations.

He had been a director of the Canadian Good Roads Association, vice-president of the Canadian Construction Association, president of the Prairie Road Builders, president of the Canadian Club, director and vice-president of the Wascana Golf and Country Club, member of the Assiniboia Club, director of the Saskatchewan Motor Club and executive member of the Saskatchewan Roughriders.

Mr. Ramsay joined the Engineering Institute as a Member in 1941.

George William Allan, M.E.I.C., of Vancouver, B.C., founder and president of Canadian Sumner Iron Works Limited and councillor and past chairman of the Vancouver Branch of the Engineering Institute, passed away on October 4, 1952.

Born at Stirling, Scotland, in 1889, Mr. Allan came to Vancouver as a child and attended school there. Returning to Scotland, he studied at the Bellahouston Academy from 1906 to 1908, and the Glasgow Technical College from 1909 to 1911. During the same period from 1905 to 1911 Mr. Allan served his apprenticeship with the Mirrlees-Watson Company in Glasgow, Scotland.

Upon his return to Canada in 1911, he entered the engineering office of the B.C. Sugar Refining Company in Vancouver. In 1912, he formed the engineering firm of Allan and McKelvie in that city, later incorporated as the Canadian Sumner Iron Works Limited. He was vice-president in 1918, becoming president in 1928. From a small machine shop and foundry the business was built into a thriving industry, specializing in the designing and manufacturing of steam engines, pulp mill and shingle mill machinery, engines and ships equipment.

During the last war Mr. Allan's company was instrumental in the designing of ships' steering mechanism which was used by all shipyards in Canada.

Professional associates recall the sincerity of Mr. Allan, the spirit of enterprise, and his use of the precise engineering method.

G. W. Allan, M.E.I.C.

Mr. Allan joined the Engineering Institute as a Member in 1942. He was a member of the Professional Engineers Association of B.C.

Barry Wilson, M.E.I.C., general manager and chief engineer of the Power Commission of Saint John, N.B., died at his home on September 15th, 1952.

Mr. Wilson was born in Saint John, N.B. He was educated in the public schools there and received his technical training at Hamilton, Ontario. Following graduation he was attached to the engineering staff of the Canadian Westinghouse in Hamilton and later engaged in construction work for that firm in Calgary and Winnipeg.

He returned to Saint John in 1918 to assume the duties of electrical engineer for the city. In 1922 he joined the engineering staff of the Power Commission of the City of Saint John and 10 years later was appointed general manager and chief engineer.

Mr. Wilson was credited with originating the Canadian Electrical Code. A newspaper article published some years ago, in 1920, gave the history of the code, and observed that Mr. Barry Wilson, then electrical engineer of the Saint John Power Commission, and city electrician, wrote the Canadian Trade Commissioner, London, regarding the approval of British apparatus. After much discussion and correspondence, in June, 1927, the Canadian Electrical Code Part 1 was approved by delegates from six provinces.

Mr. Wilson joined the Engineering Institute as a Member in 1942.

David Swan, M.E.I.C., of Winnipeg, Man., died on September 11, 1952, after a brief illness.

Mr. Swan was born in Regina, Sask., in 1914. After graduating with a B.Sc. degree in mechanical engineering from the University of Saskatchewan in 1938, he joined the Canadian General Electric Company in Toronto as draftsman in the Hotpoint division. He worked in 1939-40 as a junior engineer at Port Alfred, Que., for the Consolidated Paper Corporation.

In 1940 he enlisted in the R.C.E.M.E. and served in a field regiment in the Italian campaign, returning to Canada with the rank of captain in 1945.

Upon his return to civilian life, Mr. Swan entered Kipp-Kelly Limited, Winnipeg, as chief engineer. In 1947 he joined the Canadian Bemis Bag Co. Ltd., in Winnipeg as chief engineer. He later was appointed assistant manager of Bonar & Bemis Ltd., as well. His work was largely in the building and equipping of new plants, and modernizing and improving working conditions in the company's plants.

Mr. Swan joined the Engineering Institute as a Member in 1946. He was also a Member of the Association of Professional Engineers of Manitoba. He was a member of the board of stewards of Grace Church, Winnipeg, and served as major with the reserve army at Carpriquet barracks until a year ago.

A. R. McNeily, M.E.I.C., resident engineer for the Nova Scotia Department of Highways and Public Works, died in Sydney on August 12, 1952.

Mr. McNeily was born in St. John's, Newfoundland, in 1880, and received his education at the Methodist College there, and in private studies.

From 1901 until 1906 he held a number of land surveying positions, including one with the Newfoundland Government. He also surveyed underground for the Nova Scotia Steel & Coal Company at Wabana Mines. He joined the National Transcontinental Railway as field draftsman on location, serving in various engineering positions until 1914.

From 1915 until 1917 he was employed as district inspector of ammunition, at Trenton, N.S., and district inspector of steel. In the three years following, he served as works engineer for the Albion Machine Company, town engineer in New Glasgow, N.S., superintendent of pavement construction for Fraser Pavements Construction Company.

Until the time of the second World War, Mr. McNiely was resident engineer with the Nova Scotia Department of Highways in Halifax; later assistant town engineer at Glace Bay; and construction engineer with the Breton Construction Company, Sydney, N.S.

During the war he was senior assistant engineer with the National Defence Department at Gander, Newfoundland, where he was employed in the construction of the airport and other projects. Since that time he has been resident engineer with the Department of Highways at Sydney, N.S.

Mr. McNeily was a member of the Association of Professional Engineers of Nova Scotia, and he joined the Engineering Institute as a Member in 1948.

Employment Service

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

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

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

Situations Vacant

CHEMICAL

CHIEF CHEMIST OR CHEMICAL ENGINEER, required by a cement plant located in Newfoundland. Must be University graduate with experience in product control. Apply to File No. 4382-V.

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

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

CIVIL

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

JUNIOR CIVIL ENGINEER required by food processing plant located in Montreal. Apply to File No. 4378-V.

CIVIL ENGINEER to work as town engineer in Province of Quebec. Must be bilingual with good knowledge of sewage, waterworks, roads, etc. Salary range $5,000.00 per year. Apply to File No. 4389-V.

CIVIL ENGINEER required as soon as possible to fill the position of second assistant to the city engineer. Location Ontario. Engineer with municipal experience is desirable. Apply to File No. 4398-V.

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

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

ELECTRICAL

ELECTRONIC ENGINEER to manage photo development plant located in Province of Quebec. Applicant should have knowledge of chemistry and be bilingual. Advancement offered. Apply to File No. 4383-V.

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

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

MECHANICAL

NATIONALLY KNOWN LOCK and builders hardware firm is looking for a young mechanical engineer who is interested in industrial engineering. He will be placed in the time study and methods department in preparation for further advancement in the firm's engineering department. Applicants should be interested in tool and product design. Age, experience, marital status and salary expected should accompany letters of application. Applp to File No. 4376-V.

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

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

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

MECHANICAL ENGINEER required for expansion program by manufacturer, located in Ontario, of automotive bearings, bushings, and other precision products, for the automotive and allied industries. Age 30 to 35 years. Apply to File No. 4391-V.

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

GRADUATE MECHANICAL ENGINEER required in Montreal to act as sales promoter and organizer. Applicant should be over 30 years of age with administrative and sales experience. Equipment consists of mining machinery, rock drills, air compressors and air tools, etc. Position involves trip to Sweden. Apply to File No. 4393-V.

MISCELLANEOUS

TOWN MANAGER required in Province of Quebec. Applicant must be bilingual with good knowledge of sewage, waterworks, roads plus administrative ability Salary range $6,000.00 to $7,000.00 per year. Apply to File No. 4383-V.

REPRESENTATIVE REQUIRED by the Technical Information Service of the National Research Council to act in a liaison capacity with industry in the Toronto area. Applicants must have a degree in some field of applied science and appropriate experience would be advantageous. Apply to File No. 4387-V.

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

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

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

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

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

MECHANICAL, ELECTRICAL & ELECTRINICS ENGINEERS, Mechanical and Electrical draughtsmen, preferably with aircraft or aircraft equipment experience, required by leading airline to work in Montreal and/or Winnipeg. Salary dependent upon qualifications and experience. Apply to File No. 4402-V.

SALES ENGINEER required by well known Western Canada manufacturing concern. Applicant must have 3 to 5 years experience in sales work, preferably in heavy industrial equipment. Opportunity for rapid advancement if executive ability evident. Salary open. Apply to File No. 4403-V.

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

MECHANICAL OR CIVIL ENGINEER required by well known manufacturer of heavy mechanical equipment to supervise installations in Montreal and eventually work across Canada. Apply to File No. 4406-V.

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

CHEMICAL

CHEMICAL ENGINEER to act as development engineer in applied chemical research and process development to pilot plant stage. A bachelor's degree with high academic standing. Preferference will be given to those with post-graduate training or with proven aptitude for research and development work. Salary range $3550. to $5200. per annum according to education and years of related experience. Excellent accommodation, housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

CHEMICAL ENGINEER required to act under direction of the officer in charge of the materials section of the directorate of Armament Development, to make specific investigations and studies with respect to the use of non-metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and development organizations in Canada, the United States and United Kingdom. Graduation in Chemical Engineering from a recognized university; about six years' experience in the plastics field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

CHEMICAL ENGINEER to act under direction of the officer in charge of propellants and explosives section of the Directorate of Armament Development, to make specific investigations and studies with respect to ammunition explosives and propellants. Duties will require close liaison with the chemical industry and visits to armament design and development establishments in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in chemical engineering; about four years' diversified experience at increasingly responsible levels in the chemical engineering field; experience in development, inspection or production of explosives preferred; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

YOUNG CHEMICAL ENGINEER to locate on research staff and to man new research laboratory now in process of building. The position will entail plant process and new process research in nickel refining and related work. Location Ontario. Apply to File No. 4359-V.

JUNIOR OR INTERMEDIATE chemical engineer required to fill vacancy in the control department of a pulp and paper mill located in The Maritimes. Apply to File No. 4362-V.

CHEMICAL ENGINEER OR equivalent required by manufacturer of water treatment and conditioning equipment. Applicant will be trained in phases of work with which he is not familiar. General duties: laboratory analysis, instrument calibration, field testing and correction, study analysis, occasional sales and interview of prospects, etc., age range 25 to 35 years. Apply to File No. 4365-V.

CHEMICAL ENGINEER to act as sales engineer for organization in Montreal. Prefer a man, under 35 years of age, with industrial selling experience, particularly in the metal finishing field. Salary is open. Apply to File No. 4368-V.

CHEMICAL SALES representatives (Sherbrooke and Quebec area), the work consists of handling all phases of industrial sales, including actual sales contracts, technical service, correspondence. Large oil company located in Montreal. Apply to File No. 4369-V.

CHEMICAL ENGINEER required by company in Montreal for the industrial centrifugal department which embraces oil purification and refining, pharmaceutical problems, starch manufacture, etc. The field is new and expanding and offers wonderful opportunities. Applicant must have sales ability and be able to meet company officials. When applying please include recent photo. Apply to File No. 4208-V.

CIVIL

QUALIFIED CIVIL ENGINEER with experience in varied municipal engineering work required in Western Canada. Applicant to state age, experience and salary required. Apply to File No. 4345-V.

STRUCTURAL DESIGN ENGINEERS recently graduated or experienced. Some experience on hydraulic structures is preferable. Work for final stage of the design of power houses and dams. Consulting engineers for jobs in U.S.A. Apply to File No. 4351-V.

CIVIL ENGINEER graduate from recognized university to fill post of Deputy Director of Public Works, Bermuda. Applicant should have experience in road building and surfacing, general building construction, including reinforced concrete, steel and timber, and be capable of structural design. Experience in handling men, and in executive and administrative control is essential. Age 35 to 40. Apply to File No. 4354-V.

PUBLIC HEALTH ENGINEER required in Western Canada. Graduate Civil engineer, preferably with graduate work in public health engineering and some public health engineering experience; to make field investigations and office studies in sanitary measures for the control of diseases caused by water works, sewerage systems, stream pollutions, deficient drainage, etc. Closing date for applications Nov. 8, 1952. Apply to File No. 4355-V.

CIVIL ENGINEER to act in the capacity of resident engineer for a consultant on a project in the Quebec area. The applicant should be conversant with building construction services, survey and planning of work and also should be prepared to spend a good portion of his time on administration. Apply to File No. 4357-V.

YOUNG GRADUATE CIVIL engineer for position of transitman on a railway division in Province of Quebec. Commencement salary $275.00 a month, increases according to service and experience. Apply to File No. 4366-V.

STRUCTURAL DESIGN ENGINEER required in Western Canada. Civil engineer with not less than 5 years experience. The suitable candidate will be one who can accept considerable responsibility, which includes investigation of construction projects and submitting recommendations. He will be required to prepare designs, material estimates, etc., and will give technical direction to men engaged as designers and draughtsmen. Applications should state age, education and experience. Apply to File No. 4370-V.

ELECTRICAL

GRADUATE B.Sc., preferably with test course and sales experience in electrical apparatus equipment, age around 30 to 35. Salary open. Apply to File No. 4342-V.

ELECTRONICS ENGINEER to act under the supervision of the officer in charge of the Analysis Section of the Directorate of Armament Development to be responsible for the electronic engineering phases of the analysis of weapon systems. Duties will require visits to armament design and development organizations in Canada, the United States and United Kingdom. Graduation from a university of recognized standing in Electrical Engineering; about six years' diversified experience at increasingly responsible levels in the electronic engineering field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament Development, to make specific investigations and studies with respect to guided missiles, serve mechanisms, remote and other control systems. Duties will require close liaison with industry and visits to armament design and development establishments in Canada, the United States and the United Kingdom. Graduation from a university of recognized standing in Electrical engineering; about five years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production, ability to prepare well written reports; personal suitability, satisfactory physical condition. Apply to File No. 4347-V.

ELECTRONICS ENGINEER to act under direction of the officer in charge of the fire control and electronics section of the Directorate of Armament development to make specific investigations and studies with respect to test equipment such as velocity and radar doppler measurement, high speed scopes, monitor units, radar targets, meters, special instruments to follow flight of shell or rockets. Duties will require close liaison with industry and visits to armament design and development establishments in Canada, the United States and the United Kingdom. Graduation from a university of recognized standing in Electrical engineering; about four years' diversified experience at increasingly responsible levels in electronic engineering associated with design, development, or production. Apply to File No. 4347-V.

ELECTRICAL ENGINEERS recent graduates or experienced to work on communications with large organization in Montreal. Apply to File No. 4348-V.

ELECTRONICS ENGINEER 3 to 10 years experience in design and development of radio and T.V. telecommunications for commercial and defence projects. Location Ontario. Apply to File No. 4356-V.

Electrical Sales Engineer

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

MECHANICAL ENGINEER

For old established growing concern in S.E. Ontario within 70 miles of Toronto. Applicants must be interested in design work as applied to Materials Handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance, profit sharing and pension plan available. Apply stating experience, education and remuneration expected to File No. 4418-V.

ELECTRICAL ENGINEERS EXPERIENCED on small transformers for research and development department. Locaton Ontario. Apply to File No. 4356-V.

ELECTRICAL ENGINEER required for municipally operated electric utility in Prairie City. Preferably with 1 or 2 years experience. Duties consist of design of 13200 and 2300 volt feeder lines, pole layouts, cost studies. Some supervision of construction. Hospitalization, and medical and pension schemes, excellent working conditions. Please state age, qualifications and salary expected. Apply to File No. 4367-V.

MECHANICAL

MECHANICAL ENGINEER to act as development engineer in experimental work connected with design of atomic energy reactors and associated equipment. A bachelors degree with high academic standing. Preference will be given to those with post graduate training or with proven aptitude for research and development work. Salary range $3550. to $5200. per annum according to education and years of related experience. Excellent accommodation housing available for married staff. State particulars as to age, marital status, education and experience in detail, in first letter. Location Chalk River. Apply to File No. 4333-V.

MECHANICAL ENGINEER, recent graduate to learn air conditioning design, estimating and draughting. Location Montreal. Apply to File No. 4343-V.

WELL ESTABLISHED COMPANY requires young mechanical engineer with thorough machine shop experience, interested in sales work. Willing to pay well for capable man. Position involves trips to Europe. Apply to File No. 4353-V.

MECHANICAL ENGINEERS with 3 to 10 years experience in manufacturing, tooling and design for manufacturing for work on defence projects and home appliances. Location Ontario. Apply to File No. 4356-V.

MECHANICAL MAINTENANCE Superintendent with 15 to 20 years mechanical maintenance experience, preferably mining and milling operations. Should be capable organizer and experienced in organizing a large maintenance staff. Age 40 to 45 years, although consideration will be given to a man of exceptional qualifications outside this range. Housing available. Location Province of Quebec.

MECHANICAL ENGINEER recent graduate, to perform under direction, production design work on light steel structures, and electromechanical components. Previous experience while desirable is not essential. Salary will depend upon qualifications. Location Ottawa. Apply to File No. 4371-V.

GRADUATE ENGINEER preferably mechanical engineering, with 5 years or more of industrial engineering experience, age range 27-35 years. The duties will be to activate studies of retailing outlets of large organization, with the purpose of improving layouts of future stores and material handling, in order to obtain most effective and economical operation. Salary range is $6,000.00. Opportunities excellent for imaginative person. Apply to File No. 4375-V.

MINING

MINING ENGINEER required primarily for survey and lay-out work with anywhere from 2 to 5 years experience. Location Province of Quebec. Apply to File No. 4361-V.

MINING ENGINEER with some experience underground for position of safety engineer under supervision of safety director. Location Province of Quebec. Apply to File No. 4361-V.

MISCELLANEOUS

METALLURGICAL ENGINEER to act as development engineer in experimental work in physical metallurgy connected mainly with design of atomic energy reactors and associate equipment. A bachelors degree with high academic standing. Preference will be given to those with post-graduate training or with proven aptitude for research and development work. Salary range $3,550 to $5,200 per annum according to education and years of related experience. Excellent accommodation, housing available for married staff. State particulars as to age, marital status education and experience in detail in first letter. Location Chalk River. Apply to File No. 4333-V.

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate interested in following employment in illumination. Apply to File No. 4306-V.

PLANT ENGINEER required by one of Canada's largest textile mills located in the Maritimes engaged in the manufacture of rayon fabrics. Applicant should have executive qualifications and experience in the mechanical and electrical fields. Job covers maintenance of buildings and machinery, plant protection, planning for new projects responsibility over power and steam generation and costs. Apply to File No. 4334-V.

DRAUGHTSMAN REQUIRED by organization in Ontario. Applicant should possess either civil engineering training, structural option preferred, and some experience in steel and concrete building work, or several years experience in a good drawing office. Apply to File No. 4338-V.

PROCESS ENGINEERS to study facilities of fabrication to adequate available equipment. Study of production output to its lowest manufacturing cost. Plan sequences of operations to be followed in producing an article, specify machines, fixtures, cutting tools and set-up to be used. Qualifications: University graduate or equivalent, proven knowledge of machine shop practice (production) toolmaking. Modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

TIME STUDY AND methods technicians to complete application of time and motion study and methods engineering technique. University graduate or equivalent. Training on time and motion study. Proven experience in methods engineering and mechanical background. Good salary and working conditions in modern plant in Central Canada. Permanent work. Apply to File No. 4340-V.

SALES ENGINEER (mechanical or civil) preferably with ten years experience with industry required by a firm of industrial engineers in Ontario. Excellent opportunity for an engineer who is able to meet executives of industry and to promote engineering services. Apply to File No. 4341-V.

ELECTRONIC AND MECHANICAL ENGINEERS to do development engineering work on electronic equipment and production engineering work in the fabrication and assembly of electronic equipment respectively. Location Ontario. Apply to File No. 4344-V.

PROFESSIONAL ENGINEERS required in Province of Quebec by manufacturer of newsprint paper and Kraft products in the capacity of assistant to sulphite superintendent, assistant to technical service superintendent, and an engineer to join the maintenance and engineering department staff. Apply to File No. 4346-V.

ENGINEER to exercise supervisory and technical control over the Analysis section of the Directorate of Armament Development and to prepare assessments of the effectiveness of weapon systems in collaboration with other technical officers. Graduation from a university of recognized standing in physics, mathematics or general engineering; post graduate training with successful completion of the requirements for a Master's degree in any of the above fields; about twelve years' diversified experience at increasingly responsible levels in the fields of physics, mathematics and/or engineering. Apply to File No. 4347-V.

ENGINEER to work in consultation with the officer in charge of the Analysis section of the Directorate of Armament Development, to be responsible for mathematical phases of analysis of weapon systems. Graduation from a university of recognized standing in mathematics or applied science; post graduate training with successful completion of the requirements for a Master's Degree; about six years' diversified experience at increasingly responsible levels in the Applied mathematics and Statistical Analysis Field. Apply to File No. 4347-V.

ENGINEER (METALLURGIST) required to act under direction of the officer in charge of the Materials Section of the Directorate of Armament Development, to make investigations and studies with respect to use of metallic materials in armament design. Duties will require close liaison with Canadian industry and visits to design and

CALGARY DISTRICT PLANNING COMMISSION

Alberta, Canada

Requires An

ASSISTANT PLANNER

DUTIES:

Under the PLANNING DIRECTOR, and in collaboration with specialist colleagues, to conduct a variety of planning studies and surveys in developing a general plan for the area and to present the findings in concise reports appropriately supplemented with maps and statistical data; to perform related design (including subdivision) and administrative tasks as assigned.

QUALIFICATIONS:

University graduation in Architecture or Civil Engineering, supplemented by post-graduate training in Town Planning; some planning and successful public relations experience.

SALARY:

$3,300 to $3,900 per annum depending upon qualifications.

Apply in writing, including samples of work, to PERSONNEL DIRECTOR, City Hall, Calgary, Alberta, not later than December 15th.

development organizations in Canada, the United States and United Kingdom. Graduation in metallurgical engineering from a recognized university; about six years' experience in the metallurgical field; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

ENGINEERING PHYSICIST required to act under direction of the officer in charge of the Analysis Section of Directorate of Armament Development, to be responsible for physical engineering phases of analysis of weapon systems. Graduation from a university of recognized standing in Physics; post graduate training desirable, about six years' diversified experience at increasingly responsible levels in the physical engineering fields, ability to prepare well written reports, personal suitability, satisfactory physical condition. Apply to File No. 4347-V.

ENGINEER (BALLISTICIAN) to act under supervision of the officer in charge of the Analysis Section of the Directorate of Armament Development, to be responsible for the ballistic phases of the analysis of weapon systems, the preparation of terminal, external and internal ballistic evaluations. Graduation from a university of recognized standing in mathematics or physics, about six years' diversified experience at increasingly responsible levels in the applied mathematical field, experience in ballistics preferred; ability to prepare well written reports; personal suitability; satisfactory physical condition. Apply to File No. 4347-V.

RECENT GRADUATE chemist or chemical engineer to assume direction of laboratory for control physical and chemical plant producing abrasives. Located in Quebec. Married men preferred, housing available. Salary commensurate with experience. Apply to File No. 4350-V.

AN ENGINEER required by Western Municipality with varied programme of expansion, for position of office engineer. Applicant must have had general design experience on various types of structures and preparation of estimates and specifications. He will be required to direct a small staff of draughtsmen and compile plans of proposed works. Permanent position for one with necessary qualifications. Please give full particulars of age, education, experience, when available and salary desired. Apply to File No. 4352-V.

SANITARY ENGINEER with some experience in sewer and/or sewage treatment design and construction for Western Municipality. Permanent position for one with necessary qualifications. Please give full particulars of age, education, experience, when available and salary desired. Apply to File No. 4352-V.

SALES ENGINEERS for Toronto and Montreal, manufacturer located in Toronto of various power equipment. Apply to File No. 4358-V.

ENGINEER REQUIRED as assistant to plant engineer and for various production problems eventually leading to supervisory position for the right man. Located in The Maritimes. Apply to File No. 4360-V.

MECHANICAL OR MINING ENGINEER with some experience in ventilation work. Applicant should be definitely interested in following ventilation work. Position open is that of assistant to senior ventilation engineer. Staff accommodation available for single man. Location Province of Quebec. Apply to File No. 4361-V.

SENIOR MECHANICAL OR civil engineer with experience along mill designing and building design. Man should be a good designer and draughtsman, capable of leading junior engineers. Housing available. Location Province of Quebec. Apply to File No. 4361-V.

TELEPHONE CARRIER sales engineer, graduate engineer preferred, experience on standard type carrier in Canada desirable, would be located in Toronto or Montreal. Apply to File No. 4363-V.

CONSTRUCTION SUPERINTENDENT required immediately in Newfoundland to act as general superintendent. Contracts include large housing development as well as industrial and commercial buildings. Will make 1 or 2 year employment contract covering very satisfactory salary plus percentage of profit. Reply giving details regarding age, education, experience and income required. Apply to File No. 4364-V.

FULL INFORMATION is available for a large number of vacancies that exist for engineers in all fields of the profession to work for the Canadian Government under the Columbo Plan. Locations South and East Asia. Apply to File No. 4372-V.

PETROLEUM ENGINEER and petroleum geologist required by Public Service Commission in Western Canada. Duties, to perform field and research work on gas and oil reserves. Geologist to perform laboratory work on studies of the stratigraphy of the sedimentry area of the province. University graduate in related field such as geological, petroleum chemical or mechanical engineering, but as a geologist for the petroleum geologist position and preferably supplemented by related experience. Apply to File No. 4374-V.

Graduate Mechanical Engineer

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

National Research Council

OTTAWA - CANADA

announces a vacancy for a combustion research chemist.

Duties to conduct both research and investigation of practical problems in the combustion of gas turbine and jet engine fuels; to assume some responsibility in the guidance and supervision of this work.

QUALIFICATIONS: Graduate chemist or chemical engineer with a thorough grounding in physical chemistry; postgraduate training and relevant experience desirable. Salary dependent on qualifications and experience.

Situations Wanted

GRADUATE ENGINEER, 10 years experience, married, desires position with initiative and responsibility in plant engineering or similar work. Experience consists mainly of plant engineering in design and maintenance with a large company having a wide variety of equipment. Work included administrative, mechanical, electrical, instrumentation and various types of piping. Apply to File No. 548-W.

CIVIL ENGINEER M.E.I.C., available extensive experience in administration and all phases of heavy construction. Location immaterial. Apply to File No. 2474-W.

MECHANICAL ENGINEER B.Sc. (M.E.) M.E.I.C., P.Eng. (Ont.), 14 years varied engineering experience in design, production and administration. Desires position with scope for advancement in overall management responsibilities. Apply to file No. 2745-W.

Jr.E.I.C., P.Eng., Grad. McGill 1949, age 27, single. Extension courses in Business administration, exp. construction, surveying, municipal engineering works, estimating, costing systems, administration. Available on reasonable notice to present employer. Apply to File No. 2956-W.

Jr.E.I.C., P.Eng., grad. McGill 1949, age 27, single. Exp. design and construction of reinforced concrete and prestressed concrete, and multiple construction techniques. Familiar with contruction costing system. Available on reasonable notice to present employer. Apply to File No. 2956-W.

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

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

HEATING AND VENTILATING and electrical design services. Plans and specifications, by professional engineers. Apply to File No. 3120-W.

MANAGEMENT AND FIRE PROTECTION services surveys and reports by professional engineers. Apply to File No. 3120-W.

ELECTRICAL ENGINEER P.Eng., M.E.I.C., age 38 presently in charge of the electrical engineering section of a chemical plant, has extensive practical experience in the design, layout and construction of explosion proof electrical equipment used in the petroleum industry desires position with more responsibility. Available on month's notice. Western Canada preferred, but would consider going abroad; multilingual with extensive travel experience. Apply to File 3155-W.

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

MECHANICAL ENGINEER, Jr.E.I.C., P. Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one month notice to present employer. Apply to File No. 3460-W.

CIVIL ENGINEER M.Eng., Jr.E.I.C., P. Eng., veteran, with three years experience in designing foundations, steel and reinforced concrete structures, soil reports, soil testing and concrete inspection, desires position with construction company or consulting firm offering genuine prospects of advancement.

Montreal area preferred. Apply to File No. 3466-W.

CIVIL ENGINEER, with eight years general field experience obtained on Hydro-Electric construction, age 32, married, B.Sc., Jr.E.I.C. P.Eng., have attained responsible status; desire employment in Ontario or the West with small construction firm with eventual interest in business; presently working in isolation location. Apply to File No. 3604-W.

CHEMICAL ENGINEER, 1950 graduate of Queen's University, Jr.E.I.C., P.Eng. (Ont.), with two years production experience desires a position in sales engineering. Presently employed in specialty selling in Toronto area. Available immediately. Apply to File No. 3674-W.

ELECTRICAL ENGINEER, Jr.E.I.C., 1948 graduate, married. Desires sales position in Montreal. Experience includes two years' student engineering course with Can. Westinghouse Co. Three years with public utility on line design and construction, hydro-electric power generation and transmission, short circuit system studies, system relay planning. Apply to File No. 3841-W.

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

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

MECHANICAL ENGINEER, 1951 graduate, S.E.I.C., P.Eng., single, age 26, desires employment in Ontario or the Prairie Provinces in the field of design, maintenance and construction (plant engineering) or industrial engineering. Experience includes industrial engineering, cost estimating, time and motion study, planning floor layouts for machine product shops, machine loading, steam power plant operation, drafting and experience in the maintenance and repair of modern farm machinery. Apply to File No. 3913-W.

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

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

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

CIVIL ENGINEER, JrE.I.C., 1950 graduate desires part time work in Montreal evenings and weekends, detailing concrete reinforcing including bar lists, quantity take-offs etc. Apply to File No. 3996-W.

ELECTRICAL ENGINEER age 25, double graduate with first class honours; degrees in Pure Science (physics, mathematics) and in electrical engineering; graduate of the General Electric Test Course in Schenectady (58 weeks) and with 1½ years experience in well-known electric power concerns and utilities in Canada and overseas; desires a suitable position. Energetic with initiative and ability to pick up new aspects. Willing to travel and work anywhere in Canada or overseas. Apply to File No. 4011-V.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1949), age 30, single, R.C.A.F. veteran. Three years assistant city engineer in an Ontario city. Desires position with future utilizing municipal experience, anywhere in Canada. Available 1953. Apply to File No. 4012-V.

CHEMICAL ENGINEER, Jr.E.I.C., graduate Toronto, 1950, married, age 34, ex-serviceman, 21 months experience as assistant plant manager in English titanium pigment manufacturing company, desires good opening in Ontario. Experienced in both production supervision and investigation of a wide variety of problems. Fifteen months vacation experience with a Canadian oil company. Available for interview after October 19th. Apply to File No. 4013-W.

ELECTRICAL ENGINEER, S.E.I.C., McGill, 1951, P.Eng., Quebec, age 24, also graduate of Canadian General Electric Test Course. Presently employed with large manufacturer, desires job with greater responsibility and with a definite opportunity for advancement. Location of secondary importance. Available on several weeks notice. Apply to File No. 4014-W.

CIVIL ENGINEER, P.ENG., M.E.I.C., B.A.Sc., 1942, age 38, single. Varied experience, field and office large construction projects including logging operations, highway and airport construction, housing, docks, pulpmill. Desires responsible assignment as superintendent, project engineer, assistant plant engineer in construction or manufacturing organization. Position must require initiative, drive and executive ability. File No. 4015-W.

ELECTRICAL ENGINEER, P.Eng., Jr.E.I.C., 1948, B.Sc., in electronics. Graduate of test course of large electrical manufacturer, two years experience in testing and erection of equipment. Desires position with smaller manufacturer or in plant maintenance or production or consulting firm. Apply to File No. 4022-W.

ADMINISTRATIVE EXECUTIVE AVAILABLE. Advertiser desires administrative position in Montreal that will utilize his ability to organize and supervise, write clear reports, and maintain good public relations. He is a Civil Engineer, 31 years old, married, bilingual, and a born Montrealer. He has had considerable experience with government agencies in the construction and management of large housing projects, but would prefer now to enter into private enterprise. Apply to File No. 4023-W.

CHEMICAL ENGINEER, McGill University, 1950, Jr.E.I.C., O.A.P.E., 31, R.C.A.F., veteran, married. Presently employed by Ontario textile firm, doing laboratory work. Apply to File No. 4024-W.

MECHANICAL ENGINEER, S.E.I.C., one year experience in production, several months general engineering in paper and allied industry, presently employed desires change location. Bilingual, married. Apply to File No. 4025-W.

CIVIL ENGINEER, A.M.I.C.E., Ph.D., (Imperial College in London), 36, wishes to contact prospective employers in connection with his pending immigration to Canada. Specialist in advanced design including shell structures and pre-stressed concrete. 13 years of experience in industry, research and university lecturing. Apply to File No. 4026-W.

CIVIL ENGINEER, N.S.T.C., 1952, Jr.E.I.C., age 33, married, three children, veteran RCE, extensive experience since 1938 in highway and building construction as chief of parties and job engineer. In the services, worked as topographical surveyor "A" and in photogrammetry. Desires position with responsibility in design or construction in reinforced concrete or steel with a well established firm, or as assistant engineer or planner for a municipality. Presently employed as development assistant at C.I.L. consolidated works at Shawinigan Falls. Available on short notice. Apply to File No. 4028-W.

1952 GRADUATE IN CIVIL ENGINEERING, desires employment in soil mechanics and foundation field. Willing to accept employment in laboratory. Quebec Province preference as location Apply to File No. 4029-W.

MECHANICAL ENGINEER S.E.I.C., 1952 McGill graduate desires position with a stable Canadian firm. Experience includes maintenance construction, direction and research. Apply to File No. 4033-W.

MECHANICAL ENGINEER, Mem. ASME, B.Sc., A.M.I.Mech E., A.M.I.E.E., considerable experience senior technical and administrative positions at board levels, general mechanical engineering background with specialist knowledge uses and distribution of oxygen and industrial gases, also liquid petroleum gases, including American codes of practice, flair for getting results especially on new projects, 38, British but Canadian immigrant. Seeks interesting position any capacity anywhere in petroleum, industrial gas industry or any general engineering giving scope to drive, initiative and leadership. Apply to File No. 4034-W.

SAFETY ENGINEER, B.Sc., M.E.I.C., P. Eng., 13 years of varied engineering and design experience, 4 years specialized work in accident prevention and fire protection. Familiar with modern methods and capable of preparing and installing an up-to-date accident prevention program. Apply to File No. 4035-W.

FIELD ENGINEER, MIT civil engineer and Harvard business school graduate desires field engineering position with closely held contractor in which management and ownership participation is eventual possibility. Experience as World War II U.S. engineer officer, and as office engineer, personnel manager, and assistant to president of a large contractor. 28, married. File No. 4036-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948) desires employment in personnel, costing or planning work of any type. Four years experience in charge of municipal and public utilities in a 5000 population Ontario town including construction, maintenance and quite extensive administration. Available any where in Canada upon 1 month's notice. Apply to File No. 4037-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.Eng., 1949 B.Sc. 1947 scholarship student 1944-1949 age 25 single. Experience includes one year lecturer in chemistry at an Eastern University, two years in industrial development laboratory. Prefers job in chemical industry, anywhere in Canada. Available on approximately one month's notice. Apply to File 4038-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A.Sc. 1946, married, age 34. Three years experience administration R.C.C.S., two years own business, experienced in power distribution, four years sales engineering in electrical hardware field including product improvement and design, sales, estimating, contact with most public utility men in Ontario. Eager to prove administrative ability in progressive manufacturing company. Prefer location Southern Ontario but will consider any location. Apply to File No. 4039-W.

GEOLOGIST AND MINING ENGINEER, P.Eng., B.A.Sc., M.Sc., PH.D., age 34, married, three children. Presently employed. Thirteen years experience in mining and geology; underground mining in Northern Ontario and Quebec during three summer seasons, geological surveying in Quebec and Ontario, protecting for mining, companies, geophysical field and office work, teaching. Desires permanent responsible position with well established firm. Apply to File No. 4040-W.

CIVIL ENGINEER and chartered structural engineer (arriving in Ontario 12 Nov.), specialising in design of reinforced concrete light industrial and framed structures, seeks responsible position. Age 34, B.Sc. Eng., B.Sc. (maths and chemistry), A.M.I. Struct. E., taking final examination for A.M.I. C.E. in October. Experience comprises 3 years as reinforced concrete designer and checker with consulting engineers in London on industrial and commercial structures including liaison with archi-

tects. 7½ years miscellaneous construction experience, knowledge of modern methods of structural analysis, soil mechanics, current American design practice and J.C. and A.C.I. codes. Apply to File No. 4041-W.

MECHANICAL ENGINEER M.E.I.C., age 35, 12 years experience in lay-out and design of air conditioning, ventilating heating, cooling, materials handling, machine design and draughting. Had own consulting firm and successfully developed inventions in Sweden. Presently employed with a consulting firm as a designer for air conditioning, ventilating, cooling, etc. Desires a position with responsibility where initiative will lead to advancement. Speak perfect English. Moderate starting salary and no location preference. Apply to File No. 4047-W.

MECHANICAL ENGINEER Jr.E.I.C., age 31, married, 2 children, ex-senior officer R.C.A.F., desires position as plant engineer or assistant in the mining or pulp and paper field. Experience includes 6 years in construction, plant layout, maintenance and supervision chiefly in the mining field. Apply to File No. 4048-W.

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

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

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

ELECTRICAL ENGINEER Jr.E.I.C., (Man.) 1951, age 32, married, one child. Foreman journeyman electrician on large building construction. Electrical superintendent, large water power project. Well experienced in design of wiring for industrial and office building. Three years radar officer RCAF. Desire responsible position with contractor or consulting engineers. Apply to File No. 4055-W.

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

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

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

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

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

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

STATISTICAL ENGINEER, university graduate, specialist in mathematical statistics, familiar with sequential analysis (new technique reducing the number of observations required) seeks a job in this capacity. Apply to File 4065-W.

ELECTRICAL ENGINEER, B.Eng. Power Course, McGill 41, M.E.I.C., P.Eng., Que. Age. 33. Bilingual, married. Eleven years experience maintenance, operation, construction and administration hydro-electric generation, transmission and H. V. distribution. Desires position at management level with utility or manufacturer offering opportunity for advancement. Eastern Canada location preferred but not governing. Apply to File No. 4066-W.

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

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

Attention, Members

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

This will result in a better service to everyone concerned

TELEPHONE PLATEAU 5078

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

News of the Branches

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

Calgary

C. E. McNevin, M.E.I.C., *Secretary-Treasurer*

J. W. Thomas, M.E.I.C., *Branch News Editor*

First Meeting, Palliser Hotel, September 25

Mr. T. D. Stanley, this year's Branch Chairman, opened the first meeting of the season with a welcoming address and a brief outline of this year's activities. Mr. N. Lukes then introduced the guest speaker of the evening, Mr. J. G. Mitchell, plant engineer for Canadian Chemical Company at Edmonton.

Mr. Mitchell gave a very concise and interesting word picture of the build up of the Celanese Corporation of America in its development of synthetic fiber materials. He then outlined the work done by the Canadian Chemical Company in order to provide the raw materials necessary for the plant now being constructed in Edmonton. The construction of the Canadian Chemical plant in Edmonton is now well underway and it is anticipated that they will be going on stream in the early part of 1953.

The plant consists of three main parts: the petrochem unit, the acetate unit and the utilities unit. The plant will process 75,000 U.S. gallons of light hydrocarbon feed stock per day, supplied from local refineries, and shipped in by tank car and trucks. The supply of cellulose will come from their pulp mills in northern British Columbia. The output of the plant will be various pure hydrocarbon chemicals and cellulose acetate in fiber form, to be used in various types of cloth. Consideration has been given for future expansion of this plant in its present design to nearly three times its size.

Mr. Mitchell was then thanked by Mr. J. J. Hanna and the meeting concluded with a general get-together.

Central British Columbia

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

Dinner Meeting, September 19

The meeting took the form of a dinner with the B.C. Engineering Society. Thirty-six were present, including 20 E.I.C. members.

The general business meeting of the Central B.C. Branch of the Professional Society followed a short after dinner recess, with H. Hatfield in the chair and A. Ker acting as secretary in the absence of N. Trouth. The general business meeting of the C.B.C. Branch of the E.I.C. followed, with H. Hatfield in the chair and H. Topham as secretary.

Mr. Hatfield reported that the proposal to hold a joint Zone Council meeting with the Kootenay Branch had been cancelled and that it was going to be held in Edmonton. Mr. Hatfield also advised the members of the date of the President's visit on November 24th.

The guest speaker of the evening, Mr. T. Postle, general manager of Granby Consolidated Mining, Smelting & Power Co., Copper Mountain, B.C., was introduced by Mr. K. Fahrni. Mr. Postle gave a most informative and interesting talk on life in Chile and dealt in particular with an investigation of the Rio Blanca copper mine. Mr. Joplin proposed a vote of thanks to Mr. Postle on behalf of both groups.

General Meeting, Vernon, July 11

A general meeting, in the form of a dinner with the Central B.C. Branch of the Professional Engineering Society, was held on July 11th, 1952. Thirty were present (15 E.I.C. members).

The general business meeting of the Central B.C. Branch E.I.C. followed a short after-dinner recess, with H. Hatfield in the chair and H. Topham as secretary. In the absence of Zone Councillor Mr. M. L. Wade, Mr. Hatfield, the chairman, gave a brief summary of events at the annual general meeting held in Vancouver.

Mr. R. L. Bigg, of the Membership Committee, reported that the Branch Affiliate membership applications and forms would be discussed at the next executive meeting.

Mr. Hatfield reported that it had been proposed to hold the Zone Council Meeting at Penticton, followed by a tour of Trail. This suggestion had been forwarded to Mr. Wright, E.I.C. General Secretary, for approval. This proposal then would be formally submitted to the Kootenay and Central B.C. executives for their perusal and recommendations before final arrangements were made.

The general business meeting of the B.C. Engineering Society followed, with H. Hatfield in the chair and N. Trouth as secretary.

The speaker of the evening, Mr. T. S. Hughes, secretary-manager of the B.M.I.D., was introduced by Mr. Lloyd Willis. Mr. Hughes gave a most interesting paper on steel mills, both the equipment therein and the actual production. A series of photos were projected to explain the various aspects of his paper.

Mr. G. Meckling expressed the appreciation of the gathering to Mr. Hughes.

Cornwall

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

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

September Meeting

The first fall meeting of the Cornwall Branch was held on September 24 in the assembly room of the Howard Smith Paper Mills with B. T. Yates, the chairman, presiding.

Mr. K. B. McKay, head of the Executive Methods Division of Bois and Howard, Industrial Psychologists, was the principal speaker. The subject of his lecture was general semantics, and the members of the branch were given an introduction into the meaning and uses of this subject in industry. Jack Morris, M.E.I.C., introduced the speaker, who was thanked by R. L. Blackett, M.E.I.C.

Due to transfers from Cornwall of several members of the executive, several appointments were made to fill these vacancies. J. Morris was appointed vice-chairman of the branch; B. Stidwell was appointed to the executive; L. Snelgrove was appointed secretary-treasurer, and D. Burnham to the recording secretary's post.

D. Peat, Jr.E.I.C., told the assembled engineers that arrangements have been finalized for the Junior Engineers Lecutre Course to be held this fall. This lecture course will be similar in nature to the successful course sponsored last spring by this branch.

Eastern Townships

R. H. Blackmore, Jr.E.I.C., *Secretary-Treasurer*

Fall Sessions Start, October 10

The story of the manufacture of paper insulated power cables was told to the members of the Eastern Townships Branch of the Institute at the first meeting of the season held at the New Sherbrooke Hotel.

The talk, delivered by Maurice Mace, cable engineer of the Northern Electric Company, Ltd., Montreal, was supplemented by a motion picture showing the various phases of the construction of paper insulated cable and also outlined the various tests to which the raw materials and the finished cable were subjected to assure that they would stand up under all conditions.

Supplementing the film "Quality in Paper Insulated Power Cables," Mr. Mace also showed a film picturing the laying of a submarine high tension cable from Vancouver to Bowen Island, a distance of slightly over three miles.

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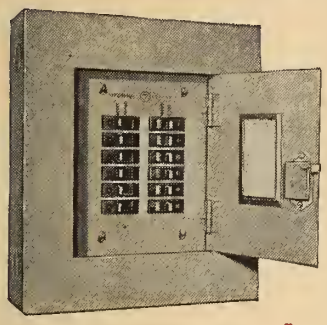

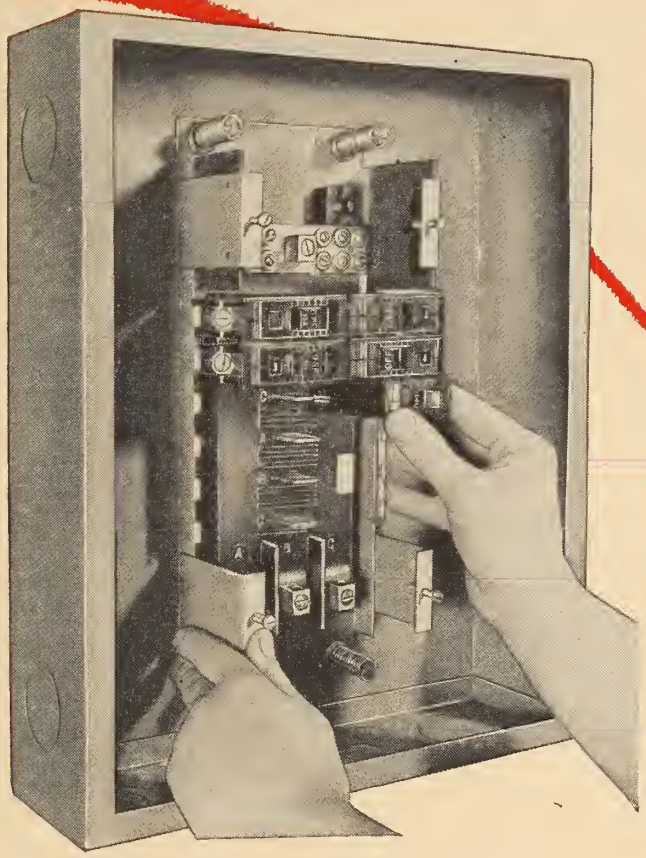

GENERAL ELECTRIC

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The new, Trumbullite Panelboard, available up to 42 circuits, has bus bars *molded in* a Plastisol base. Plastisol is highly resistant to either acid or alkali, does not "age", shrink or become brittle, resists tracking and carbonizing, resists 212° F. temperatures and has very high thermal conductivity even at 30° F. Copper bus bars encased in Plastisol run 10% cooler than in open air.

These new panelboards are available unassembled (Trumbullite Type) or as factory assembled panelboards (Type NLTQ) in either 3-wire, single phase or 4 wire, 3 phase. A C-G-E sales engineer will be pleased to furnish upon request further details on the Trumbullite Panelboards. For literature mail the attached coupon!

HEAD OFFICE: TORONTO — SALES OFFICES FROM COAST TO COAST

This cable, manufactured in the Lachine plant of Northern Electric, was made in a single length, the only splicing being at the land ends.

During the business session, a committee was named to study the possibilities of holding a series of extension lectures for younger engineers.

President George Dick also announced that the next session would deal with pre-stress concrete construction, the type of construction being used in the new Sherbrooke baseball stadium.

The speaker was thanked by Gaston Masse, superintendent of the city electric department, who also expressed thanks to Peter Pollock, local manager for Northern Electric, who arranged for the talk.

At the conclusion of the evening, a buffet lunch was served through the courtesy of Henry Downs, of the Union Screen Plate Company, Lennoxville.

Fredericton

R. E. Tweeddale, M.E.I.C.,
Secretary-Treasurer

Report of the Committee for Courses for Junior Engineers

The Fredericton Branch received its charter in November of 1951 and three months later, while still burdened with the problems of branch organization, took steps to conduct a series of lectures to assist in the professional development of its younger members.

In February the Executive asked Howard W. McFarlane, M.E.I.C., and Ira M. Beattie, M.E.I.C., to investigate the interest in this type of course among the younger members of the branch and also the possibility of obtaining local speakers. The intention of the executive was to prepare for the following season, however, the interest was so great in some quarters that it was decided to conduct a few talks in the month of April, 1952, on an experimental basis.

This short series of talks served two main purposes, the first and more important of the two being the increase in general knowledge of the attendent members, the second being the gaining of much first-hand experience to supplement the information so kindly given by other branches and by Col. Grant's office. This experience and information will serve the Committee in the planning of future courses of a more extensive nature.

The University of New Brunswick kindly made space available in the Civil Engineering Building and the speakers were only too glad to be of assistance. This meant that expenses were practically nil. The procedure was to have a one-hour talk followed by a group discussion period and a question and answer session. The students of the course took turns as chairman, introducer and thanker at each class.

Three lectures were given as follows: "Business Organization" by Doug Brewer, M.E.I.C., Chairman of the Branch, "Investments" by Russell Lambert of R. A. Lambert, Ltd., Brokers, "General Insurance" by Frank Morrison

The other members of the Committee were Horance Hughson, M.E.I.C., and Bill Barrett, S.E.I.C.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

Frank S. Gue, Jr.E.I.C.,
Branch News Editor

President Stirling Welcomed, October 16

The important event of the month was, of course, the President's visit, which was the occasion for a banquet and dance. Dr. Stirling, in greeting the Branch, said he felt he should apologize, to any who might remember the occasion, for the poor condition of Burlington's Lake Street in 1913, when he was jointly in charge of the laying of sewer works thereunder. Having been cheerfully forgiven by all present, he continued in a more serious vein to outline in interesting fashion the duties of the President insofar as they had affected him since the Vancouver general meeting in the spring.

At the conclusion of his remarks, Dr. Stirling presented certificates to the winners of the 1952 Hamilton Branch Students' and Juniors' Paper Competition, who were: Mr. M. J. McAuliffe, Jr.E.I.C., P.Eng.; Mr. J. A. Michell, Jr.E.I.C., P.Eng.; and Mr. F. S. Gue, Jr.E.I.C.

Col. Thompson, assistant general secretary of the Institute, then brought to the Branch news of bylaw changes recently recommended by Council.

The ladies and gentlemen then adjourned to the dance floor, where a most enjoyable evening was spent. The evening was pronounced a distinct success by those who attended, and drew to a close in the wee small hours of Friday the 17th.

Committees Active

The Professional Development Course of the Branch is well under way. The only complaint being heard is that accommodation is insufficient for all who would like to take advantage of it.

The Students' and Juniors' Paper Committee for 1953 is already active, with advance notice of the details of the 1953 Contest having been distributed. Under the chairmanship of Mr. J. A. Michell, one of this year's winners, the Committee is encouraging as many juniors as possible to begin work on their papers.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

D. R. Graham, Jr.E.I.C.,
Assistant Secretary

President's Visit

On October 7, the Kingston Branch held a dinner meeting in honour of the Institute's new president, Dr. J. B. Stirling. The meeting was held at the Cataraqui Golf and Country Club. Approximately one hundred ladies and gentlemen attended.

Professor J. S. Campbell was chairman of the meeting. Dr. Stirling was introduced by Mr. T. A. McGinnis. Dr. Stirling spoke of ways in which the engineering profession could gain more recognition. He stated, that through the E.I.C. we were gaining more recognition in the international field, but at home the progress was slow. He said that no amount of advertising and publicity could raise the stature of the profession.

It could be raised, however, by the efforts of engineers participating in national, civic and community affairs. Dr. Stirling was thanked by Dean D. S. Ellis of Queen's University.

During his visit to Kingston, Dr. Stirling held a meeting with the Branch executive and addressed gatherings of Queen's Engineering students and R.M.C. cadets.

Kootenay

N. H. Booth, Jr.E.I.C.,
Secretary-Treasurer

W. E. Lawrie, Jr.E.I.C.,
Branch News Editor

Technical Meeting

On June 15, Col. H. H. Minshall, field superintendent, Dominion Bridge Company, described "The Kootenay Crossing" to some seventy members and guests of the Kootenay Branch.

The Kootenay Crossing is the two-mile span across the Kootenay Lake carrying hydro-electric power from power plants on the Kootenay River to the Kimberley operations of the Consolidated Mining and Smelting Company of Canada Limited.

Col. Minshall discussed only briefly the technical aspects of the crossing; but instead concentrated on the practical difficulties and how they were overcome. Several plans were formulated and discarded before the final plan for stringing the two-mile cable was adopted. The difficulties, and their solution, encountered in using this final plan made a most interesting story.

The technical aspects of the subject have since been reported by Mr. E. M.

Head table at the Engineers' Banquet, at Hamilton. Left to right, J. A. Reid, secretary-treasurer of Hamilton Branch; Mrs. E. T. W. Bailey; Dr. J. B. Stirling, president of the Institute; Mr. E. T. W. Bailey, Branch chairman; Mrs. J. B. Stirling; Col. H. G. Thompson, assistant general secretary, E.I.C.; and Mrs. J. A. Reid.

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One of a series of advertisements on the cost advantages of magnesium.

Stiles in his paper "The Kootenay Lake Span" published in the August issue of "The Engineering Journal."

Smoker

Nearly 200 members and guests of the branch attended a smoker on September 23.

A 70-minute sound and colour film "Corrosion in Action" was shown, which calls attention on the high cost of allowing corrosion to occur. That corrosion is electro-chemical in nature was demonstrated by means of simple experiments. The results of these experiments were then used to determine methods of combating corrosion; namely, proper choice of material, protective coatings, and cathodic protection.

The film was made available by the International Nickel Company of Canada and is highly recommended for showing at meetings of other branches. The excellence of the photography and the organization and presentation of the material makes the film of interest not only to engineers, but to all those to whom corrosion represents a problem.

Professional Development Course

Following the precedent set by other branches of the E.I.C., the junior members of the Kootenay Branch have sponsored a Professional Development Course. The Course consists of a series of 18 non-technical lecture meetings to be held during the fall and winter. Leading professional and business men in the district have volunteered to give the lectures which will be open to all recent engineering graduates.

Sudbury

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

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

Dinner Meeting, October 10

The Sudbury Branch opened the 1952-1953 season with a dinner meeting at the Sudbury Granite Club.

The business part of the meeting followed the dinner. It consisted mainly of reports of the Attendance Committee, by F. Orange; Papers Committee, by J. Smith; Education Committee, by L. Lane; and Entertainment Committee, by G. Green.

The guest speaker was J. T. Thwaites, head of the electronics division of the Canadian Westinghouse Company. Mr. Thwaites is one of the leading men in Canada in the field of electronics and is a well known figure to both Canadian and American governments.

Mr. Thwaites was introduced by J. E. Quance, a former classmate at Queen's University. Mr. Thwaites gave a most interesting and informative address on "Electronics", outlining the history of its gradual development and telling of the men who made it possible.

Mr. Thwaites mentioned the many uses of electronics in industry such as power electronics, industrial calculations, traffic control, voltage regulation and process control, for example annealing and tin plating, etc. Radio and T.V. were also mentioned and Mr. Thwaites said the mining industry was beginning to use electronics and would use it a great deal more in the future.

N. J. Weedmark of the Electrical Engineering Department of The International Nickel Co., expressed to the speaker the thanks of his audience.

During the meeting an announcement was made of the visit of Dr. J. B. Stirling, the Institute president, on Monday, November 10. The President was to arrive after attending the North Bay-Temiskaming inauguration meeting to be held in Temiskaming on Saturday, November 8.

Toronto

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

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

Panel Discussion, October 2

A most outstanding meeting of this branch took place on October 2, 1952, at the Mechanical Building, University of Toronto. This was a joint meeting with the A.S.M.E., with attendance recorded at very close to 200.

The subject of the meeting was "Products, Capacity and Future of the Steel Industry in Canada", and the three well chosen speakers were: R. D. Hindson, works metallurgist, for The Steel Co. of Canada Ltd.; R. N. Dobson, sales development engineer, for the Dominion Steel & Foundries Ltd.; and

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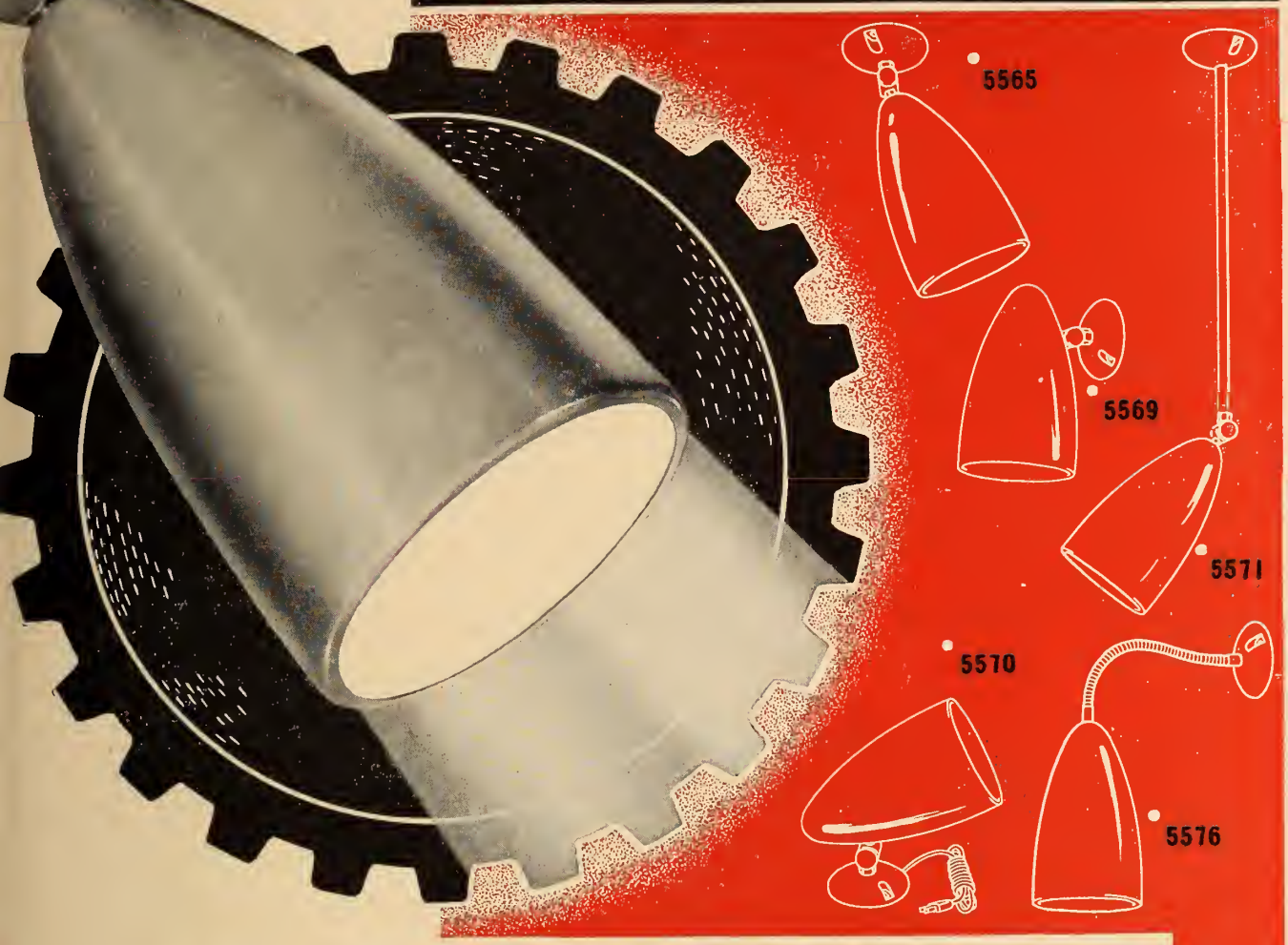

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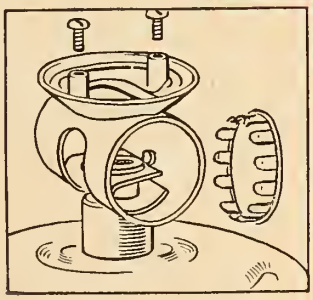

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H. B. Chambers, superintendent, Metallurgical Service, for Atlas Steels Ltd.

Dr. O. W. Ellis accepted the chairmanship for the occasion from Mr. John Hall, vice-president of the branch, who opened the meeting. Dr. Ellis introduced each speaker.

R. D. Hindson commenced his presentation with the significant remark, "As steel goes so goes the nation". He dealt with the commonly known hot rolling and general steel mill production from the blast furnace to the finished band and strip. He dealt with the history of steel in Canada, remarking on the fact that as early as 1736 there was an iron works operated at Three Rivers. It was here that the first blast furnace on the American continent was located.

The problems of the supply of raw materials to the mills around the Great Lakes, were described, and statistics were given about the large requirements of that very scarce item—scrap. In 1951 the Canadian steel industry used 2.7 million tons of scrap and it is estimated that we will require 4 million tons when the 160 million dollar expansion program is completed if it is to be kept up to capacity.

By means of a table, it was shown that Canada had increased her iron ore production 179 percent since 1939, pig iron production by 196 percent and steel production by 132 percent. The Russian figures were included and the steel production of that country, at a 51 percent increase over 1939, prompted comparison. Mr. Hindson explained that due to the German invasion of Russia considerable production capacity had been destroyed and therefore comparison cannot be very informative. Many more interesting details were presented.

The next speaker, Mr. R. N. Dobson, discussed the steel casting phase of the industry in Canada and enlightened the group by showing a number of slides. He also outlined the geographical distribution of the various steel casting foundries and what industries they served.

Mr. Dobson showed why steel castings are selected for various requirements in preference to other materials. They combine strength with ability to withstand shock and fatigue, such as in freight car applications. They combine strength with the ability to be formed into complex shapes especially in engineering structures which are extremely complicated. In such cases the highest economy in material can be accomplished.

Much interesting information was contained in Mr. Dobson's paper.

The next speaker was Mr. H. B. Chambers who presented the specialty steel phase of the industry. Mr. Chambers revealed some very interesting facts, some of which should cause Canadians to be proud. First, various classes of special steels were listed as follows: tool steels, stainless and heat resisting steels, high alloy constructional steels, and special purpose steels.

Mr. Chambers described the various applications of the 4 types of steels and presented tables that illustrated the present Canadian capacity and that of the future.

One mill in Canada has a 6 million dollar extension program underway which will provide Canada with the most modern strip mill in the world as well as a hot rolling mill that will in a single pass take 2-inch bars down to ⅛-inch thick bands, this being accomplished on the principle of planetary rolls.

It was interesting to learn that Canada is the largest tool steel producer in the British Empire, and at present stainless steel sheets are rolled up to 48 inches wide. With modification of the present equipment 72-inch sheets could be produced.

The question period brought forth many questions and the three speakers, in replying, made the subject still more interesting. Dr. Ellis diplomatically brought the question period to a close, and Ross Service, chairman of the Toronto Branch of the American Society of Mechanical Engineers, moved a vote of thanks to the speakers.

Vancouver

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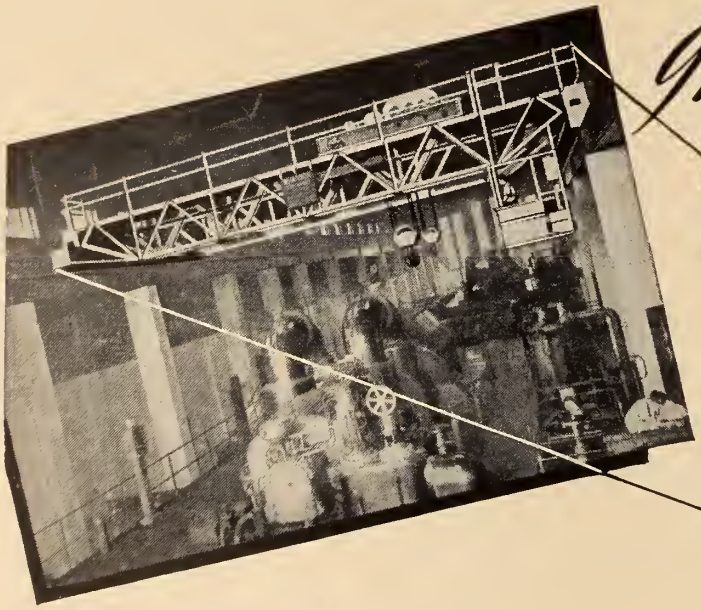
W. L. INGLIS, M.E.I.C.,
Branch News Editor

Ladies' Night

On Wednesday, October 1, the Annual Ladies' Night of the Vancouver Branch



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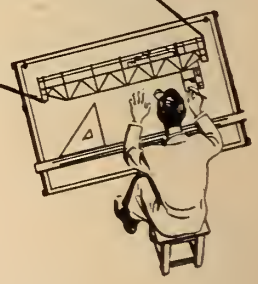

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was held in the Stanley Park Pavilion attended by nearly two hundred members, ladies and their friends.

Through the courtesy of Imperial Oil Limited, three excellent colour films were shown during the evening. "Rendezvous in the Reef" included some wonderful underwater photography showing the sea life among the coral reefs of the Bahamas. An Indian legend "The Loons' Necklace" was well portrayed, telling the story of how the peculiar markings of the Loons' feathers were supposed to have originated—the characters being dressed in Indian masks. "Newfoundland Scene" depicted life in the outposts of Newfoundland and the "joys" of fishing in the North Atlantic.

The showing of the films was preceded by cocktails and followed by other refreshments, rounding out what everyone agreed was a most enjoyable evening.

Joint Technical Meeting

A meeting of the Vancouver Branch of the E.I.C. and the Vancouver Section of the B.C. Engineering Society was held on October 8 in the new Engineering Building at the University of B.C.

The featured speaker was Mr. L. Kennedy noted authority on concrete; lecturer at Harvard University; member of the American Society of Civil Engineers and president-elect of the American Concrete Institute.

Mr. Kennedy, who was introduced by Mr. J. E. Macdonald, M.E.I.C., past chairman of the Branch, spoke on the subject "Some Factors Affecting the Quality of Concrete".

Illustrating his talk with slides, the speaker stated that the most important advance in concrete technology since the water-cement ratio has been air entrainment.

Charts were shown of the results of experiments to test the durability under freezing and thawing conditions of concrete containing different percentages of air. A definite increase in durability was evident up to 5 per cent.

The aggregate gradation is important in using an air entraining agency as it has been proved that its effectiveness is best where the largest percentage of fines are 50 to 100 mesh.

It was stated that the best quality index is obtained with 3-5 per cent of air. Other interesting factors mentioned were the reduction of water permissible and consequent increase in strength for a given quantity of cement. Offsetting this, however, is an approximate strength reduction of 195 p.s.i. for each percent increase in air content for the same water cement ratio and same aggregate. Another advantage of air entraining is the reduction of bleeding in concrete which is often evident near the surface.

A question period following Mr. Kennedy's address brought out some interesting discussion on the merits of air entrainment as well as other matters pertaining to the quality of concrete. The speaker explained that air entrained concrete requires only about one fifth of the vibration required for ordinary concrete. Replying to questions regarding curing and the use of accelerators, he said that it is essential to get curing media on concrete within four hours of placing or strength may be seriously affected; also that accelerators generally do not increase the strength of concrete beyond 7-14 days.

Mr. Keith Douglas, M.E.I.C., thanked the speaker on behalf of the audience, which numbered 150 or more.

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LIBRARY NOTES

Additions to the Institute Library

Reviews — Book Notes — Abstracts

BOOK REVIEW

A statue to Mr. Trattles, and other scientific topics. C. L. Boltz. London, Butterworth, 1952. 168 pp., $2.00.

Perhaps Mr. Trattles' name enters into this title because his story comes first in the book. He certainly bears no relation to the sixteen other sections of this fascinating volume.

But Mr. Trattles belonged to the merchant navy. At the examinations for his second mate's certificate, he was called back for a second colour-vision test, the reason being that his brother had failed in this same test at an earlier period. The long and troubled story of the innocent Mr. Trattles, and the complication he created through failing to satisfy the most eminent physicists of his day on what exactly constituted colour blindness, makes really absorbing reading. A straight solution to this problem has still never been found. That is why it is suggested that a statue be raised to Mr. Trattles.

In the section "Diamond cut diamond" you will read of how in the General Electric Company near London, diamond particles are extracted from diamond dust, accurately graded to have a maximum particle size of one micron (the human hair has a thickness ranging from fifty to eighty microns).

Are you a model maker? — boat, aeroplane, or train? The model maker scientist section will tell you how some of the most important scientific discoveries have been made with models as testing media.

Did you know that bees have a language which consists of a geometric dance capable of directing all the other bees in the hive to a source of honey, and indicating both the direction and the distance from the hive of this same honey?

What goes on inside a cathode-ray tube; who discovered X-ray and where and how; what quicksand is, or when a solid is not a solid; how an organ works, and what colour is. These and many other scientific subjects are discussed in language easily understandable to the intelligent layman.

The information was originally prepared for popular scientific talks over the British Broadcasting Corporation, and then produced in book form.

The publishers say "In publishing 'A STATUE TO MR. TRATTLES' we are breaking entirely new ground in the field of popular science."

We think you will enjoy this book. It is something really different. E.K.

LIBRARY REGULATIONS

Hours

Mon., Tues., Wed., Fri. . 9 a.m. - 6 p.m.
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Saturdays . . . . 9 a.m. to 12 noon

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Short subject bibliographies are compiled on request.

Extensive searches will be made at a charge of $3.00 per hour to members, and $5.00 per hour to non-members.

Please give as much detail as possible when requesting information of either type.

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Books, periodicals, photostats, translation, etc. may be borrowed for two weeks at a time. **A fine of 25c. per day will be charged for each day borrowed items are retained beyond this period.**

A library deposit of $5.00 at par in Montreal is required for which two items may be borrowed at one time. Temporary deposits (30 days or less) $10. Books, periodicals, etc. may be ordered by members through the library. All carrying charges are payable by the individual concerned. Except in the case of library deposits, please make **no payments in advance.**

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

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Automatic record changer service manual, including latest multi-speed changers, wire and tape recorders, Vol. 4, 1951-1952. Howard W. Sams & Co. Indianapolis, the company, 1952. Illus., $3.00.

This fourth volume covers about fifty individual types and series of multi-speed changers and wire and tape recorders. In each case it gives a description, a parts list and operating instructions. It also covers adjustments, removal and disassembly of parts, troubleshooting and lubrication. Illustrations consist of exploded views, wiring diagrams and photographs of exterior and interior. An index of this volume and of the three previous volumes is included.

Britain builds abroad; British constructional engineering in the service of world civilization 1850-1950: a tribute to the merchant adventurer spirit in the British engineering industry. Mark Joffe ed. London, Constructional steelwork export group, 1951. 276 pp., illus., 30/-.

This pictorial survey of British constructional activities abroad is divided in three parts. The first part is the most important as to size and deals with "the common achievement" of British engineers in and outside the Commonwealth and Empire: bridges in South Africa, railways in New Zealand, buildings in the Far East, pipe lines in Iran, railway stations in Argentina, etc. The second part is entitled "The common contribution" and is a survey of British constructional steelwork manufacturers and of their products and services. A third part is entitled "The supporting team" and deals with metallurgy and finance in the service of constructional engineering. It gives an outline of the British contribution to modern metallurgy and explains the economic aspect of British engineering overseas.

Building and public works administration, estimating and costing for the use of civil engineers, surveyors, and building contractors, 4th ed. Spence Geddes. London, Newnes, Toronto, British book service, c1952. 291 pp., illus., $7.00. (Canada).

This work of reference deals with the efficient administration of the works of construction, estimating the cost of the

Some Canadian Users of Timber Structures Products

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work, tendering for work, and costing the works of construction under the various component operations. Every effort has been made to make it suitable not only for the builder and contractor but also for the architect, engineer, surveyor and student. For speed of reference, the data shown for estimating purposes have been laid out under various "Trade sections" (bricklayer, concretor, fencer, mason, pile driver, pipelayer, etc.) in each of which are given tables to estimate the unit cost of the work concerned. This book is indexed and is illustrated with photographs.

CCH Canadian income tax act, consolidated to adjournment of parliament, 1952, 18th ed. CCH Canadian limited. Toronto, the company, 1952. 348 pp., $2.50.

The Income tax act, chapter 52, statutes of 1948, has eight parts as amended and deals with income tax, tax of undistributed income, tax on income from Canada of non-resident persons, gift tax, administration and enforcement, tax evasion, interpretation and transitional provisions. This eighteenth edition consolidates the amendments passed in 1949-1952 inclusive. Additional income tax provisions passed in these years and not consolidated by the amending acts appear immediately following the sections of the Income tax act to which they relate. A detailed index and necessary tables are included.

Dictionary of architecture. H. H. Saylor. New York, Wiley, London, Chapman, c1952. 221 pp., includes 16 plates, $5.63 (Canada).

This is a handy volume in which one can find the spelling, pronunciation (if unusual) and concise definition of the terms met in the study, historical reading and practice of architecture. With the purpose of saving space, the adjective, verb and adverb forms are usually omitted when the noun is listed. As to pronunciation, phonetic spelling rather than the less practical diacritical symbols has been adopted. Illustrations have been restricted to objects that are difficult or impossible to describe in words alone. These few hundred illustrations are grouped on sixteen plates bound together at the end of the volume.

The electromagnetic field. Max Mason and Warren Weaver. New York, Dover, c1929. 389 pp., illus., paper ed. $2.30, cl. $4.95 (Canada).

The present volume is an introduction to the mathematical field theory of electrodynamics, written in an attempt to keep clear the relation between the mathematical mechanism and the physical reality. Since its publication, more than twenty years ago, this classic work has met with wide acceptance. Vector methods, expansion methods and rational units are used throughout. The reader will be pleased to find in this book a subject index, a formula index, a table for change of units and a mathematical appendix giving a continuous exposition of vector analysis. This is one of the new series of paperbound scientific books published by Dover.

Electronic valves, Book 5: Application of the electronic valve in radio receivers and amplifiers, Volume 2: A. F. Amplification — The output stage — Power supply. B. G. Dammers and others. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1951. 431 pp., illus., $7.75 (Canada).

In a series of books being published on electronic valves by the Philips organisation, this is the second of three volumes devoted to the application of the electronic valve in radio receivers and amplifiers. The present volume deals with audio frequency amplification, the output circuits and the supply of power to the receiver. The fact that a volume of over four hundred pages is devoted to these subjects indicates the thoroughness of the treatment. Hundreds of diagrams, graphs and design calculations have been included to illustrate the performance of various types of valves in different circuits. A selective bibliography is given at the end of each chapter. The book is indexed and contains an appendix of valve data and characteristics.

Electronic valves, Book 7: Transmitting valves: the use of pentodes, tetrodes and triodes in transmitter circuits. J. P. Heyboer, P. Zijlstra rev. Eindhoven, Holland, Philips' Gloeilampenfabrieken, c1951. 284 pp., illus., $6.25 (Canada).

This is the seventh of the afore-mentioned Philips' series of books. It is a complete study of transmitting valves and their applications and of modulation, oscillation and frequency multiplication. In each case are derived the more important theoretical quantities for the characteristics of the valve, partly by calculation and partly by graphical means. The present book has been purposely limited to the treatment of valves in which the transit time is of minor importance. The text is not overburdened with mathematics and is illustrated by over two hundred diagrams and graphs. An index and a summary of technical data on Philips' transmitting valves and rectifiers for transmitters are included.

Elements of statistics. G. F. Lambe. Toronto, Longmans, c1952. 112 pp., $1.55.

This is a working text-book of a practical nature. A large number of numerical examples are provided and mathematical proofs are given as an aid to the logical development of the subject. Chapters deal with frequency distributions, measures of dispersion, continuous distributions, probability, binomial distribution, the normal distribution, correlation, analysis of observations, theory of errors and quality control. Although written primarily for the use of engineering students, the present work may also serve as a useful introduction to the theory of statistics for scientists and experimentalists of all kinds. It contains an index and some tables.

Manual of foreign languages, for the use of librarians, bibliographers, research workers, editors, translators and printers. 4th ed. revised and enlarged. G. F. von Ostermann. New York, Central Book Co., 1952. 414 pp., $12.50 (U.S.).

One can conjure up countless uses for this volume, which is certainly different, and quite invaluable to anyone doing editorial work or in any way involved with foreign languages.

A total of one hundred and forty-one languages and dialects are included, which also involves the transliteration of all alphabets where that is necessary.

A slight history of the languages is presented in each instance, the alphabet, both upper and lower case, and its pronunciation, syllabication, accent, articles, cardinal and ordinal numbers, months, days, seasons, and time (as of hour, day, week, month, year), and anything unusual, such as diphthongs, prepositional prefixes, comparison, pronouns, plurals, genders, verbs, etc. Besides this information, the book opens with a history of the alphabet, and its usually accepted origin. Two pages of

"selected library and bibliographic terms" follows this, and four pages of diacritical marks.

Languages and monies of the world, and Latin abbreviations form an invaluable little surprise package about one third of the way through the volume. Every thing is arranged in general alphabetical order under its classification, and in complete alphabetical order in the front listing.

To all of you who are in any way interested in this type of information, we cannot stress this volume too strongly.

Mechanics of the gyroscope: the dynamics of rotation. R. C. Deimel. New York, Dover, c1950. 192 pp., illus., paper ed. $2.00, cloth $3.75 (Canada).

The subject of this book is broader than its title indicates. It deals comprehensively with the dynamics of rotation and can even be used as a text in general mechanics. Although the student is assumed to have such knowledge of mechanics as acquired from college physics courses, the book starts at the very beginning of the subject. Chapters deal with plane motion, motion in space dynamical laws, simple gyroscopic phenomena, the free gyro, the top, motion on a plane, constrained motion, the gyro-compass and stabilizers. An index and some diagrams are included.

Numerical methods in engineering. M. G. Salvadori and M. L. Baron. New York, Prentice-Hall, 1952. 258 pp., illus., $6.65. (U.S.).

The present work is divided into five chapters which deal with the following operations and methods: the practical solution of algebraic and transcendental equations, finite differences and their applications, the numerical integration of initial value problems, the numerical integration of ordinary boundary value problems and the numerical integration of partial differential equations. It is the purpose of this presentation to introduce both the student and the practicing scientist, and in particular the engineer, to those elementary techniques which are often needed in the solution of technical problems. It is assumed that the reader has a knowledge of calculus and a smattering of differential equations. A detailed index furthers the usefulness of this book.

CORRECTION

Production Control by P. D. Donnell, published by Prentice-Hall was incorrectly priced in our August Journal. The American list price is $6.35.

Opticks, or a treatise of the reflections, refractions, inflections and colours of light, based on the 4th ed., London, 1730, with a foreword by Albert Einstein. Isaac Newton. New York, Dover, c1952. 406 pp., illus., paper ed. $2.40, cloth $4.95 (Canada).

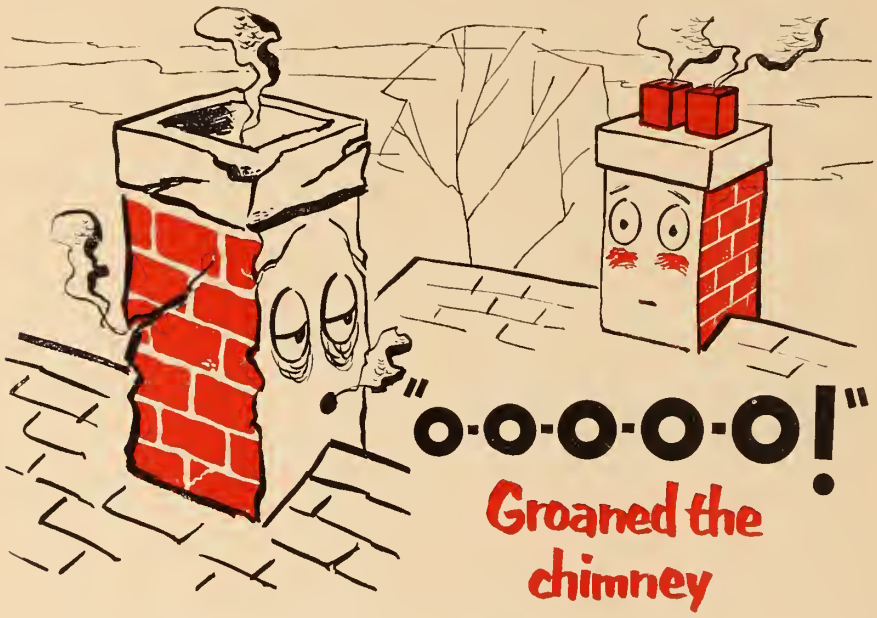
Newton's "Opticks" is surprisingly contemporary in its viewpoint, particularly with regard to the wave and corpuscular theory of light. Its broad coverage of optics, including discussions of reflection, spectroscopy, refraction, etc., makes if of interest to all general science readers. The present edition is one of a new series of paperbound scientific books published by Dover. It contains a preface by I. Bernard Cohen, a forword by Albert Einstein, an introduction by Sir Edmund Whittaker, an analytical table of contents, Newton's advertisements (reproductions of title pages and prefaces of original editions) and the three books of the "Opticks".

The pulp and paper manual of Canada 1952, 12th ed. National business publications ltd. Gardenvale, the company, 1952. 444 pp., illus., $3.00.

Two indexes make up half the contents of this volume. One is an alphabetical list of Canadian companies dealing with pulp and paper. It gives, in each case the addresses of offices and plants and the names of officials and salesmen. The other index is a classified list of equipment and supplies giving, in each case, the names and addresses of manufacturing companies. The rest of the book consists of four sections. A first section contains four articles on the study and development of equipment, while a second section contains four articles on engineering and equipment for woodlands. A third section gives flow sheets (products flow diagrams) of nineteen companies. The fourth section contains miscellaneous useful data such as equivalent of measure, specific gravities, conversion charts, etc.

The Quebec bridge 1908-1918: Report of the government board of engineers, 2 v. Canada, Department of railways and canals. Ottawa, the department, 1919. Volume 1: 259 pp., illus. Volume 2: 111 plates. $1.00.

These two volumes tell the story of the Quebec bridge from the 1907 collapse to the official opening of the rebuilt structure in 1919. The first volume contains an historical and general narrative and chapters on dimensions, substructure, tenders, design, fabrication and erection. It is illustrated with about a hundred photographs and a great number of diagrams. A very long appendix is also illustrated and deals with officials, engineering organizations and staffs, calculations of stresses, tests, etc. The second volume contains the plans according to which the Saint Lawrence Bridge company rebuilt the bridge.



"I feel so bad I think I'm going to collapse."

"What's the matter?" asked his friend on the next roof. "You certainly look sick."

"I feel all weak and wobbly. My mortar is crumbling, and my bricks are beginning to fall out. Flue gas is playing hob with me. It gets caught in my bends, seeps through my mortar-joints, and—look at me. Would you call that a healthy complexion?"

"You certainly are a bad colour," replied his friend. "I think I know what's wrong with you. Look at me. Did you ever see a healthier chimney? Well, I have Vitrified Clay Flue Lining in my inside, and factory-made offsets at each turn. Keeps me protected from combustion acids. You don't find MY mortar crumbling, or MY complexion getting mottled."

Take the Healthy Chimney's advice. Insist on VITRIFIED CLAY FLUE LINING AND FACTORY-MADE OFFSETS at each change in direction. They give permanent protection against corrosive action of flue gases and assure the life of your Chimney REGARDLESS OF THE TYPE OF FUEL USED.

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Techniques of plant maintenance 1952: proceedings of the technical sessions (sponsored by the American society of mechanical engineers and the Society for the advancement of management) held concurrently with the Third maintenance show, Philadelphia, January, 1952. New York, Clapp & Poliak, 1952. 182 pp., $6.00 (U.S.).

This is the complete transcript of formal papers delivered at the 3rd plant maintenance conference. It includes also the questions put to speakers and their answers given orally on the platform or later in writing. The following subjects are dealt with: maintenance costs; maintenance of plant buildings and of electrical equipment, in chemical plants, in metal-producing and metal- working plants; project preparation and cost control; preventive maintenance; maintenance problems of the small plant, the medium-sized plant and the large plant; training maintenance workers and supervisors; lubrication.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Annual report of the progress of rubber technology. Volume XV-1951. Edited by J. T. Drakely. London, W. Heffer & Sons Ltd., for the Institution of the Rubber Industry. 135 pp., £1.1.0.

Beginning with an historical and statistical review, this report proceeds to deal briefly with the following: planting and production of raw rubber and related products; physics and chemistry of raw rubber and rubber-like substances; synthetic rubber; manufactured rubber products such as tires, cables and electrical insulation, mechanical rubber goods, textile-rubber composites, cellular rubber, etc.; machinery and appliances. Author and subject indexes are provided for the more than 900 articles cited.

A bibliographical survey of flow through orifices and parallel-throated nozzles. (B.S.I.R.A. Research Publication, M.9). T. H. Redding. London, Chapman & Hall Ltd., 1952. 196 pp., illus., 32/6.

More than 600 entries classified under sixteen subject headings comprise this bibliography, which covers the period 1832-1946. The references are arranged in chronological order under each heading, are annotated for more effective use, and cross references are supplied to allied material under other headings. There are also an explanatory technical introduction, an author index to the bibliography, and a glossary of terms used in flow metering practice.

The cold working of non-ferrous metals and alloys. The Institute of Metals, London, The Institute, 1952. (Monograph and Report Series No. 12). 207 pp., illus., 15/–.

The following five papers comprise a symposium on the metallurgical aspects of the general subject: fundamental aspects of the cold working of metals; lubricants for the cold working of non-ferrous metals; cold rolling of non-ferrous metals in sheet and strip form; wire-drawing technique and equipment; deep drawing and pressing of non-ferrous metals and alloys. Current practice in the processes considered is effectively outlined. The general discussion of the papers is included in the book.

Die-casting. O. Herb, Editor of Machinery, New York. The Industrial Press, 2nd ed., 1952. 310 pp., illus., $4.50 (U.S.).

A practical review of current methods and equipment. The applications of the process, the machines used, and the casting of various metals are considered. Special attention is given to die steels and die design. The dies described have been classified in groups according to their most distinguishing characteristic. Alloy compositions and properties are tabulated, and many photographs and drawings are provided.

Engineering in public health. H. E. Babbitt, Toronto. McGraw-Hill, 1952. 582 pp., illus., $10.00.

Although written primarily for civil engineers, the thorough coverage of preventive and corrective measures in sanitary engineering will be useful to others in the field of public health. Among the subjects discussed are administration, control of environment for comfort and protection of health, communicable diseases with their causes and control, new germicides, and modern disinfecting methods.

Industrial waste treatment. B. B. Besselievre. Toronto, McGraw-Hill, 1952. 391 pp., illus., $8.75.

Beginning with discussion of the nature, cause, and general aspects of an industrial waste problem, the author first establishes basic methods of approach to a solution. Technical subjects covered include sampling and analysis of wastes, pollutional effects, methods of waste treatment, handling methods, and the recovery of usable materials. Legal factors and economic aspects are thoroughly covered.

Metallurgy for engineers. John Wulff, et al. New York, John Wiley & Sons, 1952. 624 pp., illus., $6.75 (U.S.).

Intended to give the reader an adequate understanding of metals for their intelli-

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gent selection and use, the first half of the book explains the concepts and principles that underlie metal processing from the ingots to the finished articles of commerce. The second half deals with the processes themselves: casting, welding, metal working, metal cutting, powder metallurgy, etc. The emphasis throughout is from the engineering rather than the shop viewpoint.

Pattern design. H. E. Kiley and J. H. Paustian. Second edition. Scranton, International, 1952. 193 pp., illus., $4.75 (U.S.).

This book covers sample patterns, molding details, pattern materials and construction, match plates and skeleton patterns. It also includes the field of pattern design and cost estimates, plus a chapter devoted to design problems. Some 200 illustrations highlight the emphasis on efficient methods. This second edition reflects the materials and processes in current use, treated concisely from the engineer's viewpoint.

Practical radiography for industry. H. R. Clauser. New York, Reinhold, 1952. 301 pp., illus., $7.50 (U.S.).

In order to provide anyone concerned with the non-destructive testing of materials with concrete working information on modern radiographic techniques, detailed formulae are given on set-up procedures, exposure factors and techniques, radiograph quality, films and film processing, screens and filters. Comprehensive coverage is also given to the interpretation of radiographs of castings and weldments and discussions of the applicable standards. X-ray generating equipment and fundamental radiographic principles are concisely treated, and separate chapters are devoted to special methods and miscellaneous applications such as thickness gaging and high-speed radiography.

Prestressed concrete structures. E. Komendant. Toronto, McGraw-Hill, first ed., 1952. 261 pp., illus., $7.50.

This book provides a basic understanding of methods of analysis on prestressed concrete structures for the man in the field as well as for the research man. After a general survey of principles and systems, the book describes the important materials and their properties. The theory of design of prestressed structures and the analysis of carrying capacity are dealt with at length, covering continuous beams, trussed girders, and prestressed shells. A number of representative prestressed structures, already built, are discussed with critical comments and suggestions for improvement.

Reinforced concrete. (Architectural and Building Series). Oscar Faber. London, E. & F. N. Spon, Ltd., Toronto, British Book Service, 1952. 232 + 55 pp., illus., $6.00.

A survey of the materials, properties, and uses of reinforced concrete, describing current methods of design, construction, and application. The book presents fundamental theory, specific design data, and numerous practical observations based on the author's experience. Separate chapters are devoted to special topics such as shell concrete, chimneys, prestressed concrete, silos, bunkers, etc. Tables and graphs are extensively used.

Tables of Coulomb wave functions. Volume I. (Applied Mathematics Series 17). National Bureau of Standards. Washington, Govt. Printing Office, 1952. 141 pp., tables, $2.00 (U.S.).

Continuing this series of publications from the National Applied Mathematics Laboratories, the present volume presents a group of special functions of particular use in the fields of nuclear physics and astrophysics. An extensive explanatory introduction and a list of literature references are also included.

BOOKS RECEIVED

Aerodynamics of the helicopter. Alfred Gessow and G. C. Myers. Toronto, Macmillan, c1952. 343 pp., illus., $7.00.

Chemical engineering operations: an introduction to the study of chemical plant. Frank Rumford. New York, Chemical pub. co., 1952. 376 pp., illus., $7.50 (U.S.).

Dictionary of conformal representations. H. Kober. New York, Dover, c1952. 208 pp., illus., $3.95 (U.S.).

Fluorescent lighting: a review of the scientific and technical fundamentals and of the applications of the fluorescent lamp and its accessories. C. Swikker ed. Eindhoven, Netherlands, Philips Gloeilampenfabrieken, Houston, Texas, Elsevier, c1952. 248 pp., illus., $6.25 (U.S.).

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

Highway curves, 4th ed. H. C. Ives and Philip Kissam. New York, Wiley, c1952. 197, 389 pp., maps, tables, $8.40 (Canada).

Manual of accident prevention in construction, 4th rev. ed. Associated general contractors of America. Washington, Associated general contractors of America, New York, American standards association, 1952. 257 pp., illus., $3.00 (U.S.).

Native tress of Canada, 4th ed. Canada, Department of resources and development, Forestry branch. Ottawa, King's printer, c1950. 293 pp., illus., $1.50.

Problems of power transmission at voltages above 225 kV. Francois Cahen. London, British electrical and allied manufacturers' association, 1952. 64 pp., illus., 5/-.

Proceedings of second conference on coastal engineering, Houston, Texas. November, 1951. J. W. Johnson ed. Berkeley, Council on wave research, University of California, 1952. 393 pp., illus., $4.75 (U.S.).

Sciagraphy. J. M. Holmes. Toronto, Pitman, c1952. 58 pp., illus., $3.50 (U.S.).

Steam trap maintenance: system troubles, their diagnosis and treatment. A. S. Wadsworth. Manchester, Emmott, c1952. 27 pp., illus., 2/6. (Mechanical world monograph No. 66).

Symposium on properties of metallic surfaces, advance copies of papers. Institute of metals. London, The institute, 1952. 293 pp., illus.

TV troubleshooting and repair guide book. R. G. Middleton. New York, Rider, c1952. 204 pp., illus., $3.90 (U.S.).

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CALGARY—Electrical Industries Ltd., 510-9th Avenue West
EDMONTON—Electrical Industries Ltd., 10105-106th Street
VANCOUVER—Thomas W. MacKay & Son, 1807 Fir Street
HALIFAX—Industrial Suppliers Ltd., 1250 Barrington Avenue

The technology of coated and processed papers. R. H. Mosher. New York, Chemical publishing co., 1952. 733 pp., illus., $15.00 (U.S.).

Thermochemical methods in silicate investigation. Wilhelm Eitel. New Brunswick, New Jersey, Rutgers university press, c1952. 132 pp., illus., $5.95 (Canada).

Year book of the heating and ventilating industry. London, Technitrade journals ltd, 1952. 284 pp., illus., 8/4.

TECHNICAL BULLETINS RECEIVED

American welding society. Recommended practices (Tentative):

No. C2.2-52T — Metallizing: Part IB — Application of aluminum and zinc for protection of iron and steel.

British electrical and allied industries research association. Technical reports:

No. G/T264 — Network analyzer study of inherent restriking voltage transients on the British 132 kV grid, by L. Gosland and J. S. Vosper. No. L/T255 — Excitation temperatures of hydrogen arcs, by H. Edels and J. D. Craggs. No. P/T105 — Commercial pulverising experience. Report based on replies to a questionnaire. No. Q/T122 — The design of capacitor-transformers, by S. Silbermann. No. Q/T129 — The measurement of copper losses in transformers and reactors. A critical review of existing methods, by M. Waters. No. W/T24 — Electrical soil warming for salad crops in frames, by A. E. Canham.

Canada. Canadian government specifications board. Specifications:

No. 3-GP-342 — Oil; lubricating marine Diesel engine (SAE-10). No. 3-GP-352 — Oil; lubricating, marine Diesel engine (SAE-20). No. 3-GP-357T — Oil; lubricating, steam turbine. No. 3-GP-362 — Oil; lubricating, marine Diesel engine (SAE-30). No. 3-GP-373 — Oil; lubricating, marine Diesel engine (SAE-40). No. 3-GP-392 — Oil; lubricating, marine Diesel engine (SAE-50). No. 3-GP-510A — Fluid; hydraulic, brake. No. 3-GP-511a — Fluid; aircraft hydraulic and shock absorber. No. 3-GP-683A — Grease; aircraft and instrument (for low and high temperatures). No. 20-GP-9 — Rubber and synthetic rubber compounds. No. 20-GP-11 — Coating material, protective; for rubber surfaces. No. 37-GP-5 — Cement; plastic, asphalt cutback. No. 37-GP-6 — Asphalt cutback; unfilled for dampproofing and waterproofing.

...Schedule of recommended methods: No. 37-GP-10 — Application of asphalt lap cement. No. 37-GP-11 — Application of asphalt cutback plastic cement. No. 37-GP-12 — Application of unfilled asphalt cutback foundation coating. — No. 37-GP-13 — Application of unfilled asphalt cutback roof coating. — No. 37-GP-14 — Application of filled asphalt cutback roof coating.

International federation for housing and town planning. Congress programs:

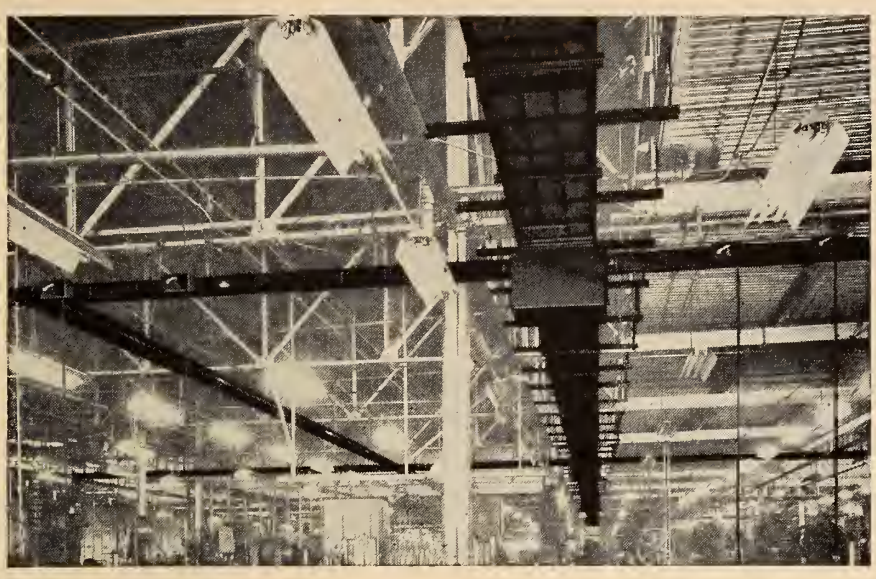
21st congress, Lisbon, 1952.

United States. Highway research board. Bibliographies:

No. 13 — Calcium chloride in concrete (Annotated).

...Bulletins:

No. 51 — Squeal of tires rounding curves.



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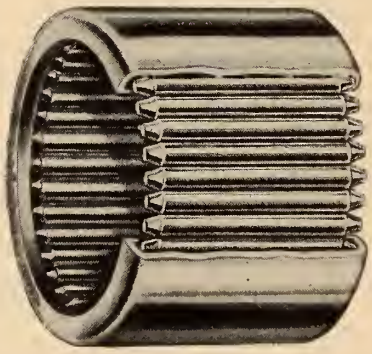

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BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information

received by

The Editor

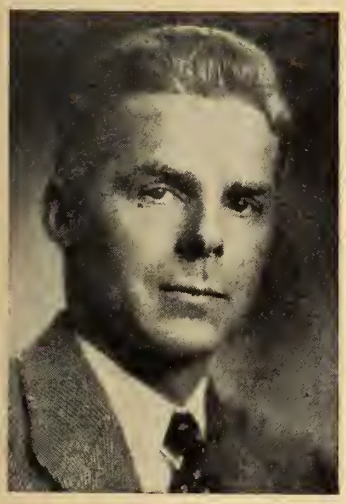
Appointments and Transfers

Patricia Engineering Appointment.—Patricia Engineering 1951 Limited, 168 Third Avenue, Timmins, Ontario, has been named northern Ontario and northwestern Quebec representative of the American Air Filter of Canada Limited.

American Air Filter of Canada Limited established its headquarters in Montreal in January of this year.

●

Bunston Ltd.—Burndy Canada Ltd., Toronto, has announced the appointment of Bunston Ltd., as western Canada sales representatives. Head office of the new representatives is in Vancouver and a branch office is maintained in Winnipeg.



A. G. Thompson

This new organization commenced operation on October 1st and it is headed by Roy F. E. Bunston, M.E.I.C. The Winnipeg branch of Bunston Ltd. will be managed by Norman L. Haney and plans call for the early opening of an Alberta branch.

A. G. Thompson has been named chief engineer of Burndy Canada Ltd. filling the position vacated by Mr. Bunston.

●

D. R. Stanley.—Dr. Donald R. Stanley has joined Associated Engineering Services, Ltd., Consulting Engineers, Edmonton.

●

G. J. Achenbach.—George J. Achenbach has been appointed a special engine representative to work with Caterpillar dealers in Vermont, Ontario, Quebec and upstate New York.

●

D. M. Jenkins.—Donald M. Jenkins, has been appointed chief engineer of General Motors Diesel Limited.

Mr. Jenkins succeeds Daniel J. Smilanich, who has completed his assignment in Canada and has rejoined GM's electro-motive division at La Grange, Illinois. Mr. Jenkins is a native of Blyth, Ont. He had been assistant chief engineer for the past four months.

●

Westinghouse Appointments.—Canadian Westinghouse Company Limited has appointed Harry E. Rice manager of the electronics division.

Mr. Rice's "management team" will include L. C. Sentance, M.E.I.C., manufacturing manager; S. S. Schneider, engineering manager, and John Houlding, sales manager.

●

Bell Telephone Changes.—Arthur F. Branscombe, of Montreal, has been appointed chief engineer of Bell Telephone's eastern area which comprises the Province of Quebec and part of eastern Ontario. His headquarters will be in Montreal.

Mr. Branscombe succeeds Arnold J. Groleau who has been appointed chief engineer, in Bell Telephone's special projects organization.

(For further information on Mr. Groleau see "personals".)

●

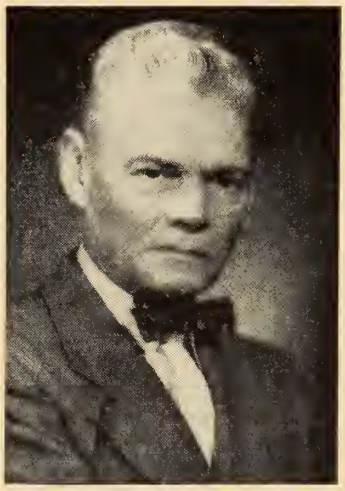
Goodyear Promotions.—The Goodyear Tire & Rubber Company of Canada, Limited, recently announced two promotions in its western Quebec Division. Leo J. Trudeau, formerly a sales representative, has been appointed manager, tire sales and Royden J. McKinnon has been made supervisor, truck tire sales in the same division. Both men will make their headquarters in Montreal.

●

Defence Production.—The Department of Defence Production announces the appointment of Howard Charles Cotterell as production administrator with the aircraft production division in Ottawa. Mr. Cotterell assumed his new post in the Department on October 13th.

Mr. Cotterell is on loan from Trans Canada Airlines where he is general manager in charge of purchasing and stores. For the past three years he has also been president of the Air Industries and Transport Associaton.

●



M. B. Mallett

M. B. Mallett.—M. B. Mallett has been appointed general manager and chief engineer of English Electric Company of Canada Limited. Mr. Mallet joined the Company in 1941 and became chief engineer in 1948. The announcement is made by H. B. Style, president and chairman. The appointment fills the

vacancy created by the resignation of A. H. Frampton, formerly vice-president and general manager.

•

Allis-Chalmers Reorganization. — In keeping with the current expansion program of Canadian Allis-Chalmers (1951) Limited, M. C. Lowe, president, announced the reorganization of the engineering dept. into three separate departments to work under the hydraulic and industrial divisions instead of the manufacturing division. This organization will speed up the processing of orders and will give closer contact between sales personnel and engineering.

R. Mark is now manager, pump engineering dept. of the hydraulic division; R. Passmore is manager, turbine engineering department of the hydraulic division; W. Heyden, M.E.I.C., is manager, industrial engineering of the industrial division.

D. Hurrell, formerly manager, engineering dept. has been appointed works engineer. In this new capacity, Mr. Hurrell will be responsible for liaison between the manufacturing division and engineering departments.

•

New Monsanto Department.—Monsanto Canada Limited and its subsidiary, Barringham Rubber and Plastics Ltd., Oakville, Ont., have announced the establishment of a new advertising and public relations department in Montreal.

The decision to organize a separate department to co-ordinate the Company's advertising, public relations, publicity, and sales promotion programs is necessitated by Monsanto's rapid expansion in the Canadian chemical field since manufacturing operations began in 1945.

The new department will be headed by Donald R. Dawson.

•

B.C. Road Builders.—Hugh A. Martin, of Marwell Construction Company Limited, has been elected president of the Road Builders and Heavy Construction Association of B.C.

First vice-president is J. E. R. Wood, well-known Vancouver construction engineer and second vice-president is Carl Anderson, of Emil Anderson Construction Company.

•

New Equipment and Developments

Dominion Tar & Chemical Co.—Arthur H. Martin, president of Dominion Tar & Chemical Co. Ltd., recently announced plans for the expansion of Canada Cresoting Company's plant at North Edmonton.

Additional equipment and adjustment of present facilities will result in a 25 per cent increase in the North Edmonton plant's treating capacity. Some increase in storage facilities is also provided for.

The new equipment includes pole framing and mechanical peeling machinery which will enable all year production of round wood products such as communication and power poles and pilings.

The new facilities will enable the Edmonton plant to treat with preservatives other than Creosote—Pentachlorophenol, for example. These facilities have been available at the Company's Calgary plant for some time.

The new facilities are expected to be in use by early 1953.

•

Airfield Runways.—A new type of asphalt surfacing for airfield runways, capable of resisting the severe erosion caused by jet engines of normal surfaces, has been evolved by Shell technicians.

Ever since the introduction of the jet engine the possible effect of high temperatures and blast on runways, taxitracks and warming-up areas has caused anxiety. With more and more jet fighters coming into service this has become an urgent problem and it has received priority attention by technicians at Shell's Thornton laboratories in Cheshire, U.K. Their research work has produced a jet resistant asphalt carpet completely resistant to heat and blast, yet it has the great advantage that it can be made and laid with standard asphalt surfacing. In other respects it closely resembles a conventional asphalt surfacing. For further information communicate with Shell Oil Company of Canada Limited, 25 Adelaide St. East, Toronto 1, Ontario.

•

(*Continued on page 1282*)

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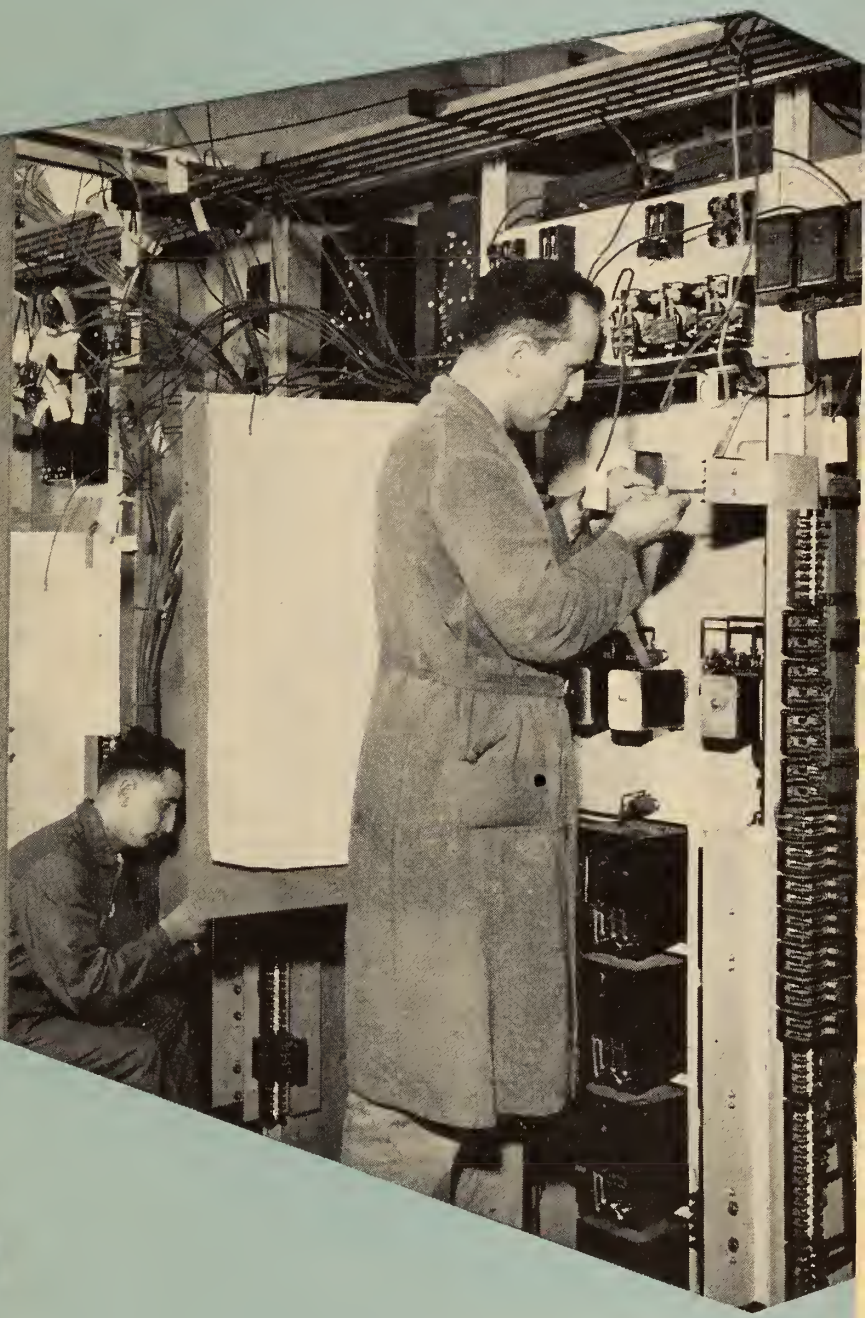

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MINE EQUIPMENT Co. Ltd., Kirkland Lake, Ont.
GENERAL EQUIPMENT Ltd., Halifax

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1278*)

C.G.E. in Ottawa.—A new office-and-warehouse building in Ottawa was opened recently by Canadian General Electric Company. Located at 175 Richmond Road, the two-storey building is of brick and concrete construction and contains about 75,000 sq. ft. of floor space.

•

Monotube Drier.—Economical drying and cooling—and a new means of obtaining by-products and recovering solvents—are three of the functions of the inexpensive, compact new Link-Belt Monotube drier which this Company has developed. Following extensive laboratory and field tests this addition to the Link-Belt line of driers is now available for general use.

The monotube drier operates on the conduction principle of heat transfer. There are no air currents through the material bed. Dusting is practically eliminated, and it is possible to dry materials having fine particles which readily become air borne. Materials as light and fluffy as cake flour and cottonseed meal can be dried successfully.

The drier is made in two trough diameters—24 in. in lengths from 5 to 10 ft. and 30-in. in lengths from 5 to 20 ft.

There is only one moving part—a paddle conveyor on a hollow shaft. Steam, hot liquid or coolant circulates through the shaft and outrigger tubes, producing efficient transfer of heat as the material is churned and conveyed through the trough. Constant agitation assures uniform drying without overheating. For further details write to Link-Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, Ontario.

•

Woodpulp & Newsprint.—Order-in-Council P.C. 4212, dated October 9th, 1952, removes pulpwood and newsprint from the list of materials declared essential under the Defence Production Act.

•

Scrap Metals.—Representative of steel mills, foundries and scrap companies got well past the half-way mark recently in modernizing their code for grading iron and steel scrap. The new set of specifications is expected to be completed before the end of the year.

Members of the ferrous metals division, Canadian Secondary Materials Association, and representatives of scrap-consuming industries, the steel companies and foundries, met in joint sessions in Toronto to discuss the details of each proposed grade of scrap. The new code will bring up to date scrap trade specifications that have not been substantially revised since World War II. Based on various mill and foundry requirements, there will be 27 or more different grades of scrap established for preparation by dealers to standard specifications.

Complete information on the new specifications may be obtained from Canadian Scrap Iron & Steel Committee, Inner Court 33 Scott Street, Toronto 1, Ontario.

•

Photo-flash Checker.—To fill a need for a simple and inexpensive method for checking the condition of batteries, sockets and wiring connections in photo-flash synchronizers, the Canadian Westinghouse Company has announced the availability of two "Flash-Check" lamps.

The PT-1 Flash-Check has an SC bayonet base and G-6 bulb and is designed for use in flash holders using photoflash bulbs No. 5, 6, SM, or any of the midget sizes.

The PT-2 Flash-Check has a medium screw base and uses the S-14 bulb. The PT-2 fits all sockets for medium and large sized flash lamps, such as No. 11, 22 or 50.

•

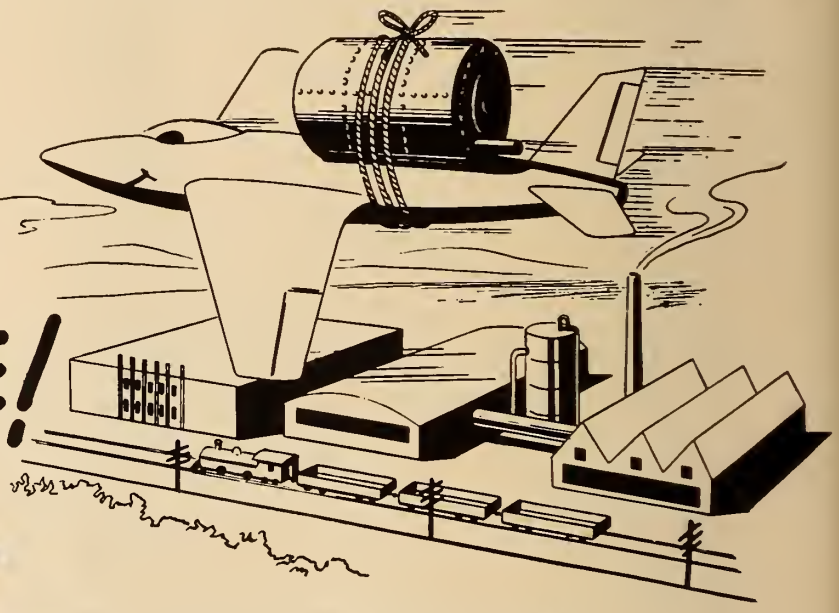
New C-I-L Laboratory.—Canadian Industries Limited has completed a new paint and varnish research and development laboratory on Castlefield Road, just west of Dufferin Street, in York Township, north of Toronto. Official opening ceremonies were held on October 29th before a large attendance of members of industry and the press.

The visitors were welcomed by B. F. Twining, manager of the Company's paint and varnish division and then addressed briefly by J. W. Brock, development manager of the paint and varnish division. M. R. Feely, chief chemist, also addressed the gathering.

The official opening ceremony was performed by the York Township Reeve and then the visitors toured the plant. Later a social gathering was held in the Royal York Hotel.

•

Brazilian Power Plant.—A complete 5,000 kilowatt unit power plant and two



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EJ

unit sub-stations have been ordered by the Brazilian city of Fortaleza from the Westinghouse Electric International Company. The apparatus will provide the northeastern seaport with its first modern source of electric power.

Both generating and substation apparatus are of a standardized type designed by Westinghouse to reduce preliminary engineering and procurement problems. In each case, besides manufacturing all electrical equipment involved, the Company is co-ordinating the purchase and supply of mechanical components.

•

Atlas Steel Buys New Equipment.—The first machine in Canada for the continuous commercial casting of steel has been ordered by Atlas Steels Limited for installation at Welland, Ontario. It will be used in the manufacture of high speed, tool, stainless and special alloy steels and is scheduled to be in production by late 1953.

In announcing the purchase of the machine, R. H. Davis, president, said "this revolutionary development in steel production will yield from 10 to 15 per cent more finished steel per heat than conventional pouring method."

"This latest expenditure will bring the total to 11½ million dollars spent by Atlas on new production equipment since early 1950. While much of this has been devoted to equipping the Atlas plant for producing hot and cold rolled stainless sheet and strip, the billet casting will be used in the manufacturing of Atlas high speed, carbon and alloy tool and other special alloy steels as well."

Operation will be under Rossi-Junghans patent agreements which are controlled in Canada and the United States by Continuous Metalcast Company of New York City.

•

Cominco Development.—At the confluence of two powerful rivers 13 miles south of Trail, B.C. an industrial giant is growing. The $30,000,000 Waneta Power Plant of The Consolidated Mining and Smelting Company is being built on the Pend-d'Oreille River a short distance from its junction with the Columbia, and is well advanced. Nearly 1,100 men are currently employed on the job.

Cominco announced the project in the spring of 1951 and work got under way in June of that year.

•

Canadian Liquid Air Plant.—Canadian Liquid Air Company has opened a new oxygen and acetylene plant at Port Arthur. This plant will provide a convenient source of supply of gases, welding equipment and supplies for the mining, pulp and paper, aircraft, shipbuilding and other industries in the Lakehead area. In the case of the shipbuilding industry the Liquid Air plant is so situated that the Port Arthur Shipbuilding Company will be supplied with both oxygen and acetylene by direct pipeline.

This new plant is another link in a long chain of Canadian Liquid Air plants, stretching from Newfoundland to British Columbia and encompassing all the principal Canadian industrial centres.

•

Kellogg Contract.—The Humble Oil & Refining Company has awarded the M. W. Kellogg Company, New York City, the contract for the design and construction of a unique solvent deasphalting plant at Humble's Bayton (Texas) refinery.

•

British Industries Fair.—An eloquent plea for more Canadian buyers to attend the 32nd annual British Industries Fair to be held in London and Birmingham from April 27 to May 8, 1953, was made recently by Sir Archibald Forbes, president of the Federation of British Industries.

"This is the best possible opportunity," said Sir Archibald, "for overseas buyers to see for themselves the large range of British goods on display. This will be particularly so in 1953 since special efforts are being made at the Fair in Coronation year. I need hardly emphasize that every dollar spent by Canada in the United Kingdom would be virtually returned in the purchase of Canadian products."

Since the war Canadian buyers have been fewer in proportion to those coming from the United States, commented Sir Archibald. But it was hoped that next year's attendance would tell a different story. Canadian buyers were assured of a specially cordial welcome.

Advance copies of the 1953 British In-

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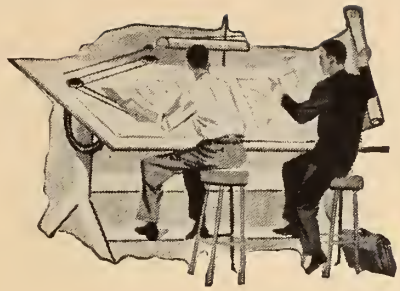

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as yet on the drawing boards

The machinery world is one of new ideas, improved methods and different applications. With each advancement lubrication requirements also change.

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dustries Fair Catalogues will be available for general distribution in Canada for the first time.

In view of the tremendous crowds of people who will visit Britain during the Coronation year it is recommended that prospective visitors to the Fair make their reservations now.

•

Gardner Denver Manufacturing.—A line of Gardner-Denver Air-Cooled Compressors and Tank Mounted Outfits are now being manufactured at the Gardner-Denver works in Brantford, Ont.

The Brantford plant is producing single-cylinder, single-stage compressors in three sizes—the 2-in.-by 2½ in. Model ACA, the 2¾-in.-by-2½ in. Model ACB and the 3 in.-by-3½ in. Model ACC. They are available as base compressors with V-belt drive from motor, or as complete tank mounted units.

Other Gardner-Denver products manufactured at the Brantford plant include WXO Two-Stage air compressors, air feed legs and line oilers.

•

Wallace Clark Expansion.—Wallace Clark & Company Inc. of New York announce the opening of a Canadian branch to be known as Wallace Clark & Company (Canada) Ltd. The head office of the new organization will be located in the Royal Bank of Canada Building at 360 St. James Street, Montreal.

The Company serves in a management consulting capacity. It is a charter member of the Association of Consulting Management Engineers.

•

A Mobile Loading Platform.—A mobile loading platform has been introduced by Lansing-Bagnall Ltd., of Basingstoke, in the English county of Hampshire, to facilitate the loading and unloading of railway goods wagons directly from and to road vehicles by means of power pallet trucks. This new unit is portable and obviates necessity for loading bays when transferring loads between vehicles.

The unit consists of a simple four-wheeled trailer on which there are two platforms hinged together at an intermediate point. These platforms are adjustable for height and can be raised or lowered through mechanical screw jacks and a linkage system. One platform section — that used at the rail wagon end—remains in a horizontal position at all levels. It has a vertical movement of from 3 feet 9 inches to 5 feet 3 inches above ground level, and is 6 feet long by 6 feet wide. The other platform section — which connects the horizontal platform to the road vehicle — is 10 feet long and 6 feet wide. Its outer end has a vertical movement of 3 feet to 4 feet above ground level, and through this height adjustment the platform is used to form a sloping ramp between the road vehicle and the horizontal platform set at the rail wagon floor level.

The two sides and end of the horizontal platform section and the outer end of the sloping platform are fitted with hinged flaps which are let down to act as bridge plates when the unit is in use. When the loading platform is in position and its sections adjusted between the rail wagon and the lorry, loaded pallets can be freely moved between the vehicles by means of a small pallet truck.

•

Wire Rope Clamping System.—A wire rope clamping system which makes splicing unnecessary and saves materials and labour has been made available by Cable Covers, Ltd., of Talurit Division, St. Stephen's House, London, S.W.1. Essentially it is a method of providing splices in wire ropes of all diameters up to 40 millimetres in the standard range and up to 60 millimetres when necessary by placing two thicknesses of the rope into the "Talurit" ferrule which is subsequently swaged in a press so that the ferrule and the two thicknesses of rope are moulded into one homogeneous mass occupying the same space as normally one thickness would do. The system has been tested: it was found that under load the wire rope breaks first and the copper-free aluminium alloy ferrule remains intact.

•

The G.E.C. Cathode-Ray Tube. — A new cathode-ray tube, type 908 C.A.R.A., is announced by the General Electric Company, Ltd., of Magnet House, Kingsway, London, W.C.2, for use in high-speed oscillography. The tube, which utilises electrostatic focusing and deflexion, has a 9 centimetre

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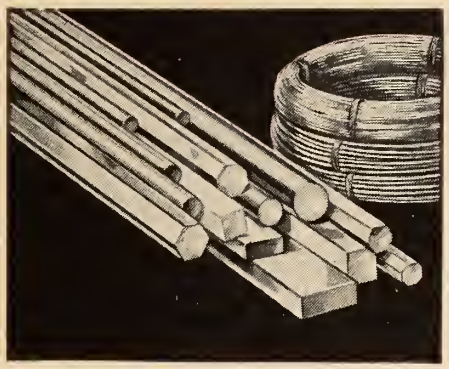

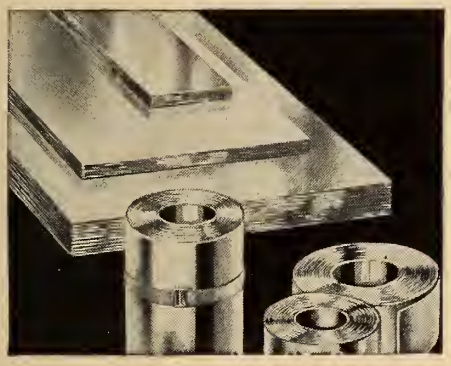

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C-5227

diameter flat-faced screen coated with a highly actinic powder giving a blue fluorescence. One stage of post deflexion acceleration is employed, which enables the beam to be accelerated after the main deflexion has taken place. Connexions to the front plates are brought out of the envelope via side arms, while the connexions to the back plates and the third anode are taken through the base.

This new tube has only two side arms, which saves space where a number of tubes have to be used in multi-channel recording; it has a post-deflexion stage, and it is suitable for work demanding a better tube than the E.4412.B.9 but not justifying the use of a more elaborate type.

The operating conditions of the C.R.T. are as follows: it has a heater voltage of 4v., and heater current of 1.1 amps; the first anode voltage is 2.0kv., the second 220v. approximately, and the third 4kv.; the post-deflexion accelerator voltage is 8kv., and the cut-off voltage—70v. approximately; it has a back plate sensitivity of 0.11mm per volt and front plate sensitivity of 0.08mm.

●

Photo-Copying Machine. — The new Remington Rand Remflex copier—a facsimile photo-copying machine — duplicates documents, printed material and books in less than two minutes. The prints produced are suitable for making dye-line copies without needing a special translucent paper. The paper used is less sensitive to light than ordinary photo-document paper and so can be handled in normal lighting conditions more freely. Only small amounts of chemical fluid are needed to make a copy, and the chemicals are dispensed as and when required. The makers are Remington Rand, Ltd., of 1-19, New Oxford Street, London, W.C.1.

●

Heavy-Duty Fork-Lift Truck. — Shelvoke and Drewry, Ltd., of Letchworth, in the English county of Hertfordshire, recently demonstrated their new "S.D. Freight-lifter" heavy-duty fork-lift truck, which has a capacity of 15,000 to 18,000 lb. and lifting height of 12-20 feet. A four-tier stack of steel channel in 20 foot lengths and weighing 44,800 lb. was taken down in four operations and transferred to another site and re-stacked in five minutes. Two iron castings, each weighing 7,840 lb. were lifted in one operation and the loaded truck was then driven at speed and manoeuvred to show the ease of operation. Another demonstration was the lifting of a lorry together with 1,100 gallon tank, which had previously been loaded on to the lorry, to the full height of the mast.

More than 600 municipal authorities in Britain and overseas use "S.D. Freighters," and the new fork-lift truck is backed by a world-wide network of distributors. Orders have already been received from Australia, New Zealand, South Africa, Norway, Sweden, France and French Morocco.

●

Aluminium-Alloy Building. — A light-alloy framed canteen building for a research institute has recently been constructed by Structural and Mechanical Engineers, Ltd. (S.M.D.), 2, Buckingham Avenue, Slough, in the English county of Buckinghamshire. It has aluminium-alloy portal frames, consisting of extruded hollow 6-inch by 3-inch box-section members, at 9 foot centres. The rafters are exposed below the low pitch roof. The cavity walls comprise a brick outer shell with a 3-inch inner shell of light-weight insulation blocks. The roof is made up of 2-inch Stramit boards supported on aluminium T-section purlins; it is surfaced with bituminous built-up roofing. A roof light of curved Perspex sheets is provided. Metal-framed windows are set in precast concrete surrounds. The new canteen comprises the first bay of a series of standardized single-storey buildings, each to house a specialized laboratory, and each connected to a two-storey general laboratory and administrative block.

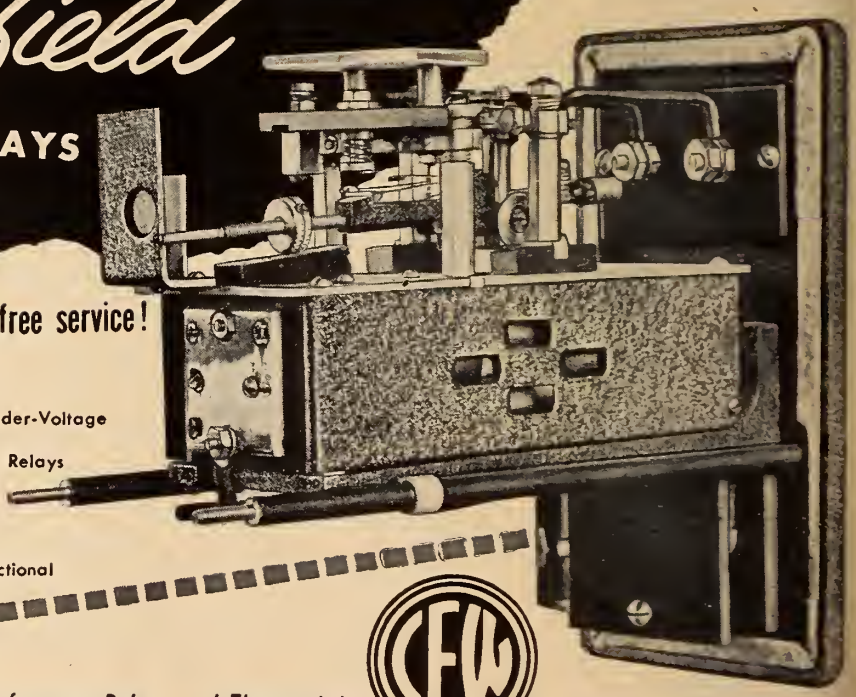
●

P.V.C. Fluorescent Fittings. — Rigid polyvinyl chloride as developed by Imperial Chemical Industries, Ltd., is used as the reflecting material in the fluorescent lighting fittings which have just been brought out by New Era Industries, Ltd., Stoneleigh Road, London, N.17, England. The material can operate in the most corrosive atmospheres without any great loss in its reflective properties and in this respect it is claimed to be equal to vitreous enamel and superior to stove-enamelled steel. It is robust and virtually unbreakable. The fittings consist of a formed steel spine so made that the rigid P.V.C. reflectors are easily detachable, the control gear being mounted within the spine. Both single 5-foot and twin 4-foot fittings are available.

●

Cansfield

PROTECTIVE RELAYS



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- Types L, H, and F Control and Auxiliary Relays
- Types FT, LT Definite Time Relays
- Combination Relays
- Type K Annunciator and Alarm Relays
- Type C1 High-Speed Impedance Relays
- Types EC7, EC9, EC08 High-Speed Directional Relays

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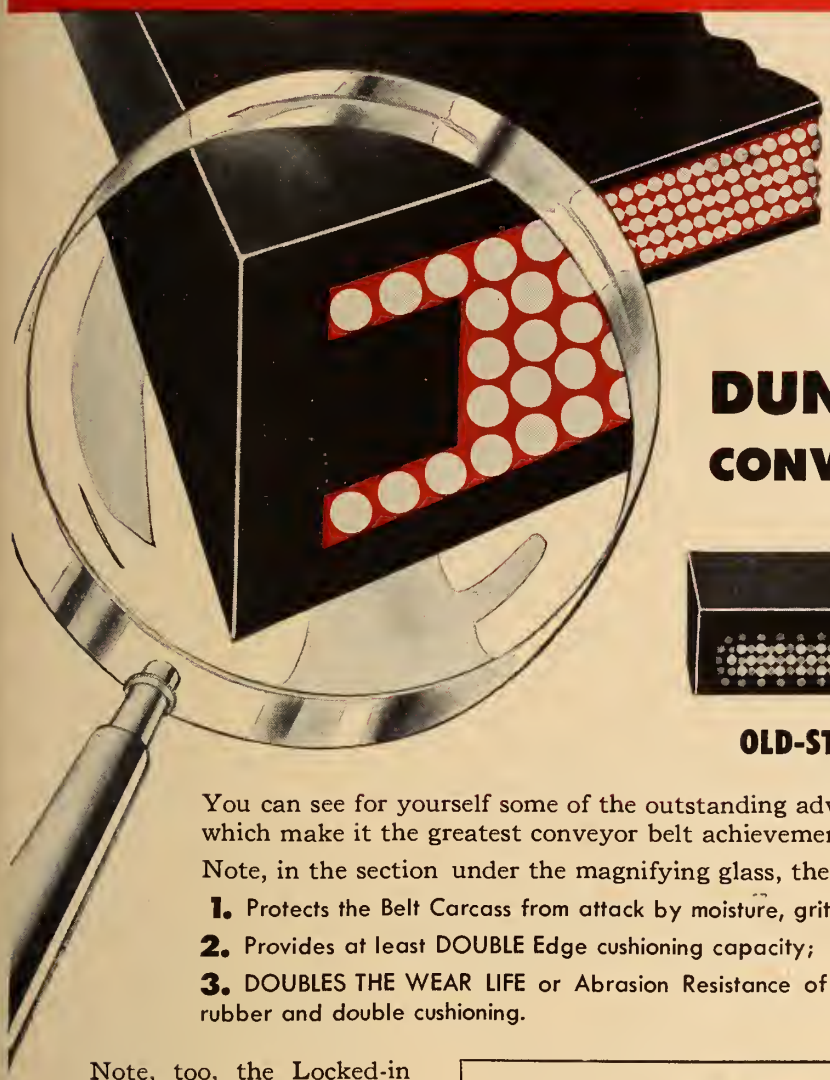


AND THAT'S JUST ONE OF THE ADVANTAGES OF

The NEW DUNLOP *"Flexlok"* CONVEYOR BELT EDGE

as compared with

OLD-STYLE CONVEYOR BELT EDGE

You can see for yourself some of the outstanding advantages of the new Dunlop "Flexlok" which make it the greatest conveyor belt achievement since 1925.

Note, in the section under the magnifying glass, the extra edge rubber which—

1. Protects the Belt Carcass from attack by moisture, grit, acids, alkalis or oils;

2. Provides at least DOUBLE Edge cushioning capacity;

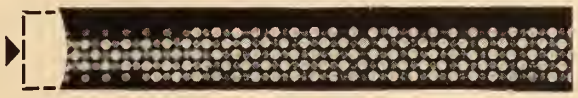
3. DOUBLES THE WEAR LIFE or Abrasion Resistance of the Belt Edge, as a result of the extra rubber and double cushioning.

Note, too, the Locked-in Anchorage of the Edge Rubber. This Locked-in Anchorage so increases the stability of the Belt Edge that it is possible to DOUBLE the thickness of Edge Protection Rubber, hold it in place, and secure the advantages shown above.

Yes, you greatly lengthen service life . . . and save money, too...with Dunlop "Flexlok" Belt Edge. (World-wide patents.)

Compare the results, too

Worn "Flexlok" Edge



Conventional Belt Edge with Equal Wear

Note that the Carcass of the Flexlok Belt is still well protected as compared with the exposed Carcass of the Conventional Belt Construction.

For further information about Dunlop "Flexlok" Belt Edge, write Dunlop Engineering Service today.

DUNLOP-CANADA

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

English Electric Journal.—The English Electric Company of Canada Limited, St. Catharines, are Canadian distributors of "The English Electric Journal". This is a first class company publication which is now in its twelfth volume. The contents are of a technical nature and every issue is beautifully produced and well illustrated with photographs.

To be placed on the mailing list of this important publication, write to the Company at St. Catharines on your official letterhead.

•

Plumbing Supplies.—Josam Canada Limited, 267 Davenport Road, Toronto, are manufacturers of plumbing drainage products of a type used extensively in commercial and industrial buildings.

They have released, recently, their Manual T which covers the various types of drains, valves, interceptors and special fittings they manufacture. To obtain copies of this publication, write to the Company and ask for "Manual T".

•

New Trane Booklet.—Trane Company of Canada Limited have issued an excellent publication entitled "Merely a Matter of Air". It describes the new Unitrane air conditioning system. This new system uses no ducts, each supplies its own air for ventilation purposes. All air is filtered at all times.

Each room has its own compact, inconspicuous, under-the-window heating and cooling unit requiring approximately as much space as a conventional heating unit. Each tenant selects his own temperature the year round. Each room has its own thermostat. Each unit is under automatic control.

Installation is very simple as the Unitrane uses water as a heating and cooling medium. The same simple piping circuit that supplies warm water to the units for heating in winter, also supplies chilled water for cooling in summer. Change-over from warm water to cold water is automatic. Complete information and a copy of the publication "Merely a Matter of Air" may be obtained by writing to Trane Company Limited, Mowat and King St. W., Toronto, Ont.

•

Geological Report.—Geological Report No. 51 has just been released by the Honourable C. D. French, Minister of Mines for the Province of Quebec. It is on the Olga-Goéland Area, and describes the results of a two year geological exploration conducted by P. E. Imbault for the Geological Surveys Branch of the Quebec Mines Department.

Copies of the report and its accompanying coloured map may be obtained by writing to the Department of Mines, Parliament Buildings, Quebec.

•

Stressteel Manual.—Formation of the Stressteel Corporation to produce the only large diameter, high strength steel tensioning units for the prestressing of concrete is announcing with the publication of the STRESSTEEL MANUAL, a comprehensive handbook describing the new material and its uses.

Stressteel tensioning units, consisting of bars ½ in. to 1⅛ in. in diameter and up to 80 in. in length, together with their end anchorages, were developed by Donovan H. Lee, a London consulting engineer, and McCalls Macalloy Ltd., of Sheffield, England.

Stressteel Corporation has been established by a group of American and Canadian businessmen to manufacture and sell the units in North America and in Cuba, the Philippine Republic and the territories of the United States, under license from the proprietors of the Lee-McCall system.

This new material is immediately available to the American construction industry by import from England under the same Price List which will prevail when domestic production starts. Nego-

Solve Corrosion Problems with McAVITY "Ni-Resist" VALVES

"Ni-Resist", the nickel alloyed cast iron, is notable not only for greater toughness and strength, it shows remarkable resistance to corrosion. In the pulp and paper industry in particular, valves made of "Ni-Resist" have proved their ability to withstand corrosion, abrasion and erosion to an unusual degree.

All McAvity-Milwood Gate Valves can be supplied in "Ni-Resist" . . . with trim and packing suited to the conditions concerned. In addition we can supply Globe, Angle and Swing Check Valves in "Ni-Resist" . . . also Fittings, Piping and Special Castings. Full information from our nearest branch.

FIGURE 10298 NIR-SS

McAvity-Milwood Gate Valve in "Ni-Resist" with Stainless Steel trim.

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Q: Why does TRANSITE PIPE last longer under these Winnipeg streets?

Transite Pipe was first installed by this Manitoba city nearly 20 years ago. Its lasting strength and high corrosion resistance have enabled it to outlast pipe previously used, several times over.

A: Modern Research designed it for lasting strength

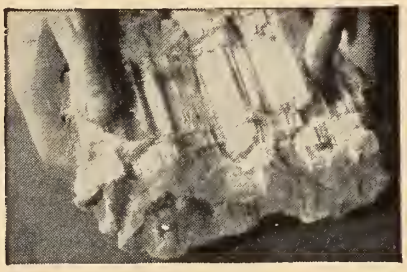
Today, across the country — under countless city streets like the one shown above—Transite* Pressure Pipe is doing a highly efficient job of transporting water . . . often under conditions so adverse to ordinary pipe that engineers marvel at Transite's ability to stand up through the years!

The reason? *Lasting strength!*

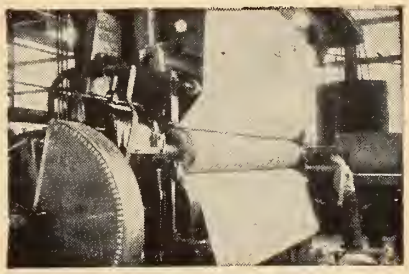
Not only does Transite Pipe have the *initial* strength that's needed in a pipe intended for use under busy city streets. Equally important, it has the *lasting* strength that enables it to survive continued corrosive attack, year after year . . . to keep on giving the same dependable, economical service to the community as the day it was installed.

This highly important quality of lasting strength is one of many notable inherent advantages of a pipe engineered with modern water transportation requirements in mind. Transite's Simplex Couplings reduce leakage losses to a minimum, provide flexibility to help relieve the line of soil stresses and traffic loads. Its light weight makes for easier handling and effects substantial savings during installation. Its smooth interior assures a high coefficient of flow (C = 140) and, because Transite can never tuberculate, helps keep pumping costs low through the years.

Why not get all the details . . . find out how this modern-engineered-for-the-job asbestos-cement pipe can help solve your water-line problems and *save you money?* For full information write Canadian Johns-Manville, Dept. 393, 199 Bay St., Toronto.



Tough, strong asbestos fibers reinforce Transite Pipe — contribute to its high corrosion resistance and lasting strength.



On machines like this, the asbestos-cement-silica mixture is "built up" under heavy pressure into a dense, homogeneous pipe structure.

Transite's flexible Simplex Couplings help relieve the line of excessive flexural stresses — an added safeguard against pipe failures.

Johns-Manville TRANSITE
Asbestos-cement PRESSURE PIPE

JOHNS-MANVILLE JM PRODUCTS

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Write for catalogue showing typical installations, charts, graphs, etc.

BLM AUTOMATIC CLUTCH CORPORATION OF CANADA LIMITED

165 SPADINA AVENUE, TORONTO, ONT.

tiations for a manufacturing plant in Pennsylvania are now nearing completion.

Officers of the Stressteel Corporation are Curzon Dobell of New York, president, Gerald Bronfman of Montreal, vice-president and Edward Schechter of New York, treasurer. Headquarters are at 207 East 37th Street, New York 16, N.Y.

To obtain copies of the Stressteel Manual communicate with the Headquarters of the company at the address given in this item.

•

Ferranti Transformers.—Ferranti Electric Limited, Mount Dennis, Toronto 15, have just completed production of their Distribution Transformer Bulletin No. 107 which shows the various standard lines of distribution transformers and gives information including dimensions, etc.

This is a well produced bulletin and will be very acceptable to engineers who wish to have available the latest information on Ferranti transformers.

To obtain copies write to Ferranti Electric Limited at the address given above and ask for Bulletin No. 107.

•

C-I-L Oval.—The October 1952 issue of the C-I-L Oval contains some most interesting articles: "Steel and Civilization" by S. L. Gertsman of the Department of Mines and Technical Surveys, Ottawa; "Canada's Fabulous Iron Ores" by W. M. Goodwin, mining engineer, Ottawa; "Flaming Furnaces and Roaring Mills" by R. D. Hindson, works metallurgist, Steel Company of Canada, Hamilton, Ont.; "Chemicals for Coatings" by W. B. Billingsley, Chemical Department, C-I-L; "Fashioning Pipe and Wire" by W. E. Bown, vice-president, Dominion Steel and Coal Corporation; "Tailoring in Steel" by Peter Miller, general superintendent, Lachine Plant, Dominion Bridge Company; "The Order of The Bath" by Eatha G. Setterington and "The Problems of Protection", by R. W. Spears of Paint and Varnish Division, C-I-L; "At Home and on the Road"; and "Today's Research is Tomorrow's Practice", by Dr. John Convey, director, Mines Branch, Department of Mines and Technical Surveys, Ottawa. To obtain copies write to the Editor, C-I-L Oval, Box 10, Montreal, Que.

•

Jeffrey Manufacturing Catalog.—The Jeffrey Manufacturing Co. Ltd., P.O. Box 428, Montreal, Quebec, announce the release of catalogue No. 843 on Electric Vibrating Packers and Packing Tables. This new publication illustrates and describes packing units that offer opportunities for economy in modern industry.

The catalogue illustrates the Jeffrey-Traylor Barrel Packers. These Packers consists of a heavy, rigid vibrating head to induce straight line vertical vibration producing maximum densities and shortest packing time.

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These packing units are of the same basis means of vibration as the Jeffrey-Traylor wide range of vibrating feeders and conveyors economically handling and controlling the flow of many kinds of materials in various industries throughout Canada. To obtain copies of Catalogue No. 843, write directly to the Company.

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Foxboro Bulletin.—Bulletin No. 447 has just been issued by the Foxboro Company, Foxboro, Massachusetts. It contains complete details of temperature recorder construction, showing how each component part, from bulb to chart, contributes to recorder accuracy. Its 20 pages provide factual information, assisting in the understanding, selection

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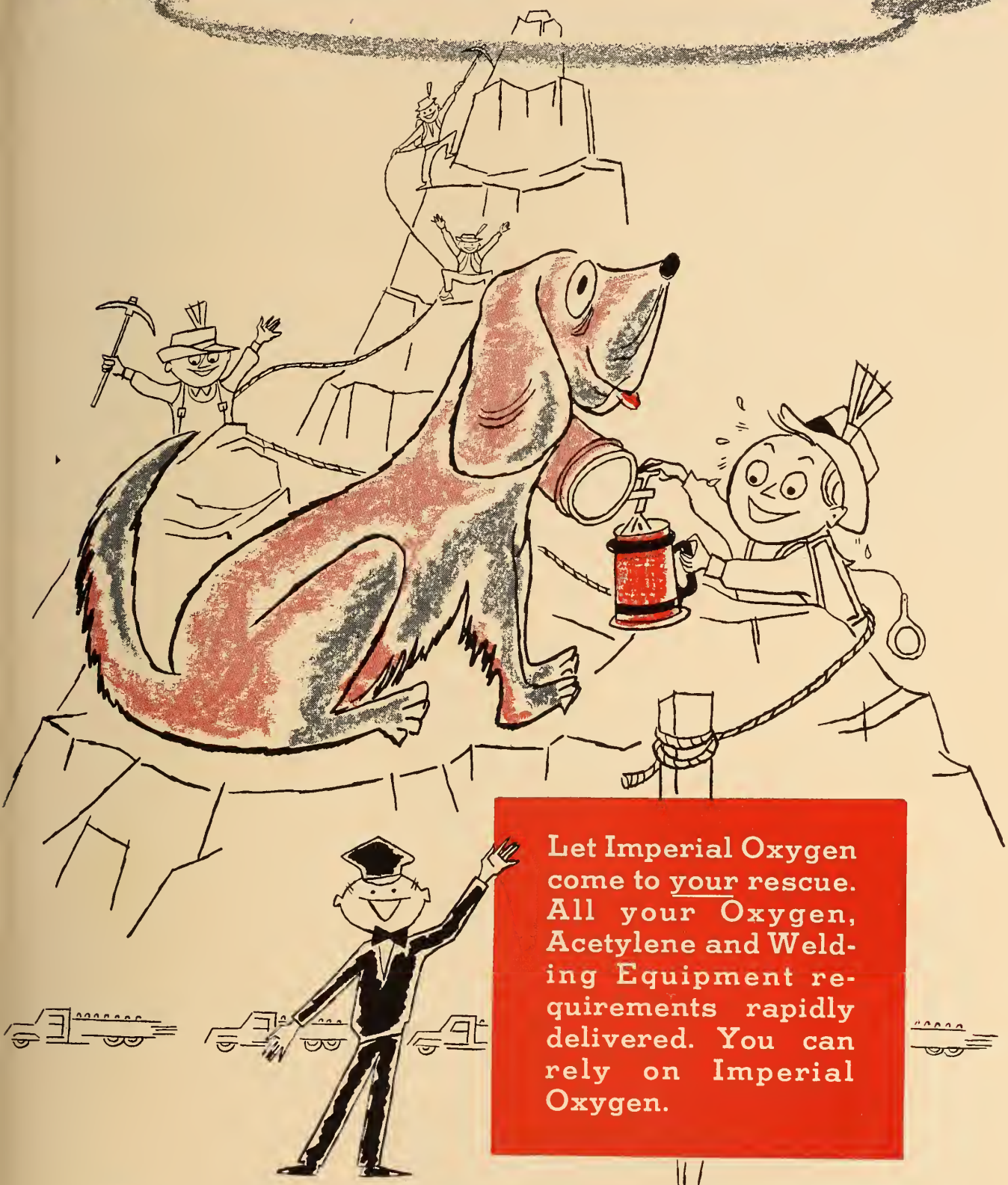

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Small Link Chain.—An industrial chain so tiny that five pitches make up less than an inch of chain is described and illustrated in a new book No. 2510 published by Link-Belt Company.

Drives using this chain are built into many types of machinery where quiet, positive transmission of fractional horsepower at high or low speeds is required.

To obtain copies of the publication write to Link-Belt Company Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, and ask for the bulletin by number: No. 2510.

●

Map of Abitibi Area. The Quebec De-Department of Mines has released for distribution a geological map covering 18,000 sq. miles in Northern Abitibi. The area embraced extends from the Ontario boundary eastward to beyond Chibougamau Lake and lies between latitudes forty-nine and fifty. The map is lithographed in blue and black and is in two sheets, on a scale of 4 miles to the inch.

This publication, Map No. 961, titled "Northern Abitibi and Chibougamau", is available on request to the Department of Mines, Parliament Buildings, Quebec.

●

"Power For Steel".—Canadian Westinghouse Company Limited, Hamilton, Ontario, have issued a very good publication "Power for Steel". The publication gives an excellent presentation of a few of the more important Westinghouse accomplishments in the field of electrical equipment for steel mill application.

The booklet is well produced and highly informative. To obtain copies write to the company at Hamilton and ask for "Power for Steel."

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"Arc & Flame".—Canadian Liquid Air Company, 1111 Beaver Hall Hill, Montreal, are publishers of the "Arc and Flame". This pamphlet is of a highly informative nature and will be most useful to engineers who are interested in welding.

To be placed on the mailing list, communicate with the company.

●

Gear Bulletin.—Hamilton Gear and Machine Co. Ltd., 950 Dupont Street, Toronto 4, have issued a new bulletin "Small Worm Gear Reducers". This pamphlet gives new power ratings for the company's size 22 to 51 worm gear reducers. It is designed for insertion in our catalogue 106-C.

To obtain copies communicate with the Company and ask them to keep your name on the mailing list for future bulletins.

●

Power Line Materials.—Canadian Line Materials Limited, Toronto 13, have issued a company magazine "The Line" for a number of years. This publication will be interesting to engineers whose work is connected with power line equipment. To be placed on the mailing list for regular receipt, communicate with the company.

●

Diesel Engines.—Russel-Hipwell Engines Limited, Owen Sound, Ontario, are Canadian distributors of an excellent magazine "The Dependable Diesel". This is a magazine produced for power users. The contents are well presented and most interesting as they cover all phases of diesel application.

To obtain copies write to the company at Owen Sound.

●

Aluminum and Building Industry.—The Aluminum Company of Canada Limited have produced an excellent publication "Aluminum Sheet-Metal Practice in the Building Industry". This is a highly informative, beautifully produced publication and it will be of great value to engineers who are engaged in the construction industry. The publication is of a very expensive nature and therefore it is recommended that requests be made on official letterheads. Address requests to the Aluminum Company of Canada Limited, Sun Life Building, Montreal, Que.

●

"Facts About Glass."—Pilkington Glass Limited, 165 Bloor St. E., Toronto, offers a series of data sheets "Facts About Glass". For copies apply to the Company at the address given above.

●

Coal Board Report.—To obtain copies of the 4th annual report of the Dominion Coal Board—covering the fiscal year ending March 31st, 1952, write to the Queen's Printer and controller of Stationery, Ottawa, Canada. The price is $0.25.

●

Bepco Journal.—No. 6 of Volume 10 of the Bepco Journal contains a very informative paper called the "Clowhom Falls Project" by Lionel A. Hunt, Vanvouver manager, Bepco Canada Limited. The same issue contains an interesting paper "Three Phase Versus Single Phase" by R. C. Cook of the Company's Transformer Department.

To obtain this and other issues of the Bepco Journal, write to the Company at 4018 St. Catherine St. West, Montreal 6, Que.

●

Steam and Water Heaters.—The care and maintenance of steam and hot water unit heaters is covered in a new, four-page publication released by the Canadian Fan Manufacturers' Association, P.O. Box 275, Windsor, Ont. Well illustrated and concisely worded, it covers the procedure in getting the most of these efficient heating units. Write to the Association for copies.

●

S.K.F. Data Sheets.—The Canadian SKF Company Limited, P.O. Box 183, Postal Station "H", Toronto 13, produce a useful series of engineering tables and charts. The range now numbers from 1 to 55.

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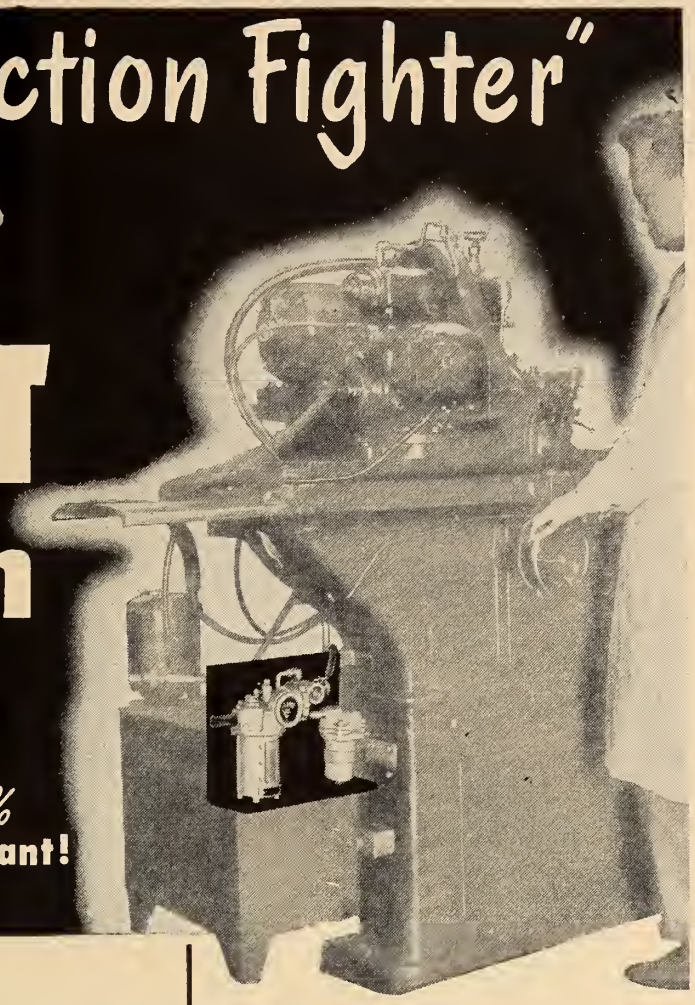

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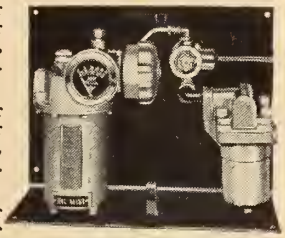

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Cleveland Worm Catalogue. — The Cleveland Worm & Gear Company, 3290 East 80th Street, Cleveland 4, Ohio, has just completed a new catalogue covering machine drives and speed reducers. The publication contains 180 pages which illustrate and describe all models in the complete line of Cleveland Worm Gear Speed Reducers—with full engineering data. To obtain copies of this important publication, write to Peacock Brothers Limited, Town of LaSalle, Montreal, Que. Please make applications on official letterhead.

•

Threaded Screw Products.—To provide every user of threaded screw products in Canada with an informative and functional treatise on every type of screw fastener available, of Canadian manufacture, The Steel Company of Canada, Limited, has issued a 100 page booklet giving facts and figures essential to users of these products. The booklet is made up in a form whereby revisions as they occur can be added. For copies write to W. A. Bates, The Steel Company of Canada, Limited, Hamilton, Ontario, and and ask for "Screw Products and Bright Goods".

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Air Diffuser. — A new square diffuser, styled for acoustic-type ceilings and designed to retain the characteristic advantages of the circular Kno-Draft outlets, has been announced by the W. B. Connor Engineering Corp.

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•

Drafting Table. — A new bulletin released by the Stacor Equipment Company shows a four post steel drafting table. Except for the kiln-dried soft wood top and "prestwood" dust cover, the entire table is of steel construction. The bulletin describes three table models, each available in several board sizes. To obtain copies write to Stacor Equipment, 473 Troy Ave., Brooklyn 3, N.Y.

•

Vibrating Feeder. — Henry Simon Limited of Stockport, England are now offering under the trade name "Velofeeder", a vibrating feeder with an extremely wide range of performance and low power consumption. The system of impact, by which the vibrations in the feeder are produced, has never before been utilized in industry, according to a statement released by the manufacturer, and its application to this type of feeder is, therefore, novel and interesting.

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•

Multi-Louvre Dryers. — A new 24-page book No. 2409 on Multi-Louvre dryers has been issued by Link Belt Limited, Eastern Avenue at Leslie and Keating Streets, Toronto 8, Ont. This dryer is widely used by the coal, food, chemical process and fertilizer industries for materials which require fast treatment and accurate temperature control. Copies will be forwarded by the Company upon receipt of requests.

•

New Liquid Air Price Lists. — Canadian Liquid Air Company Limited, 1111 Beaver Hall Hill, Montreal, Que. have issued a new price list covering gas welding rods, fluxes and accessories. Copies may be obtained by writing to the Company.

•

New Fuses. — Canadian Westinghouse Company Limited, Hamilton, Ont., have issued a new publication on Boric Acid Power Fuses. The bulletin is highly informative and well produced. Copies may be obtained by writing to the Company.

•

Moulded Cups. — The Garlock Packing Co. Ltd. offer a well produced publication entitled "Garlock Molded Cups". The folder contains illustrations of various types of cups, service data, and a complete list of sizes and part numbers. Typical applications are also shown. Write to any Garlock branch for copies.

•

Atlas Steel News. — Atlas Steel News is a publication issued each month by Atlas Steel of Welland, Ont. No. 1 of volume 6 contains interesting information on stainless steel containers and a second article is entitled "Ceramic Coatings Increase Temperature Range for High-Temperature Alloys". To obtain copies of this publication, write to, The Editor, Atlas Steel News, Welland, Ont.

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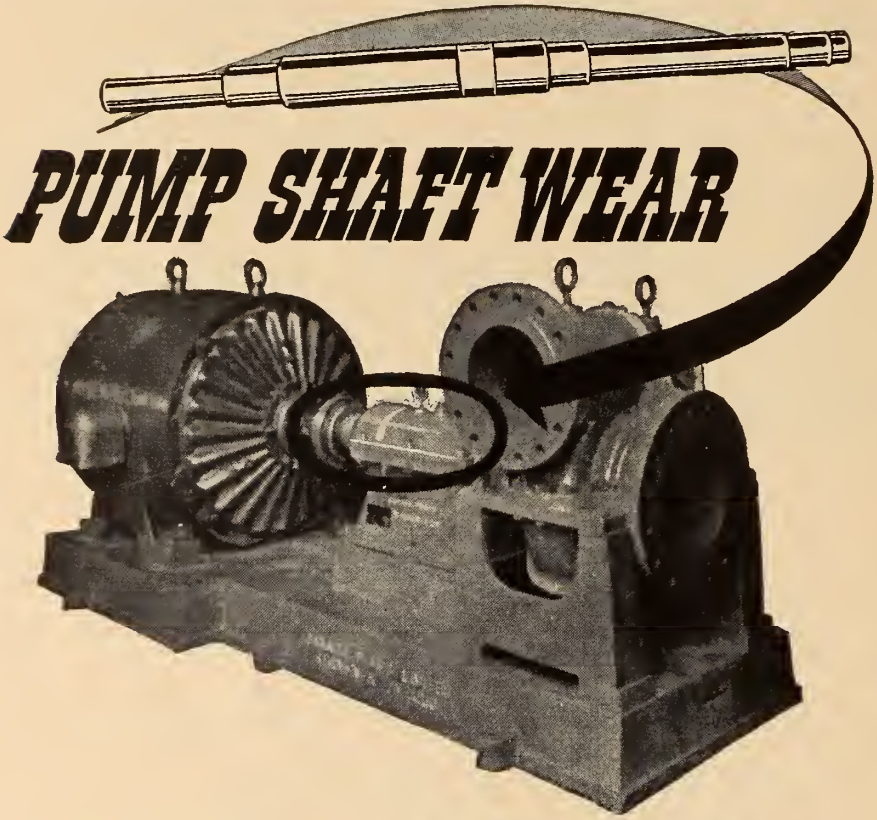

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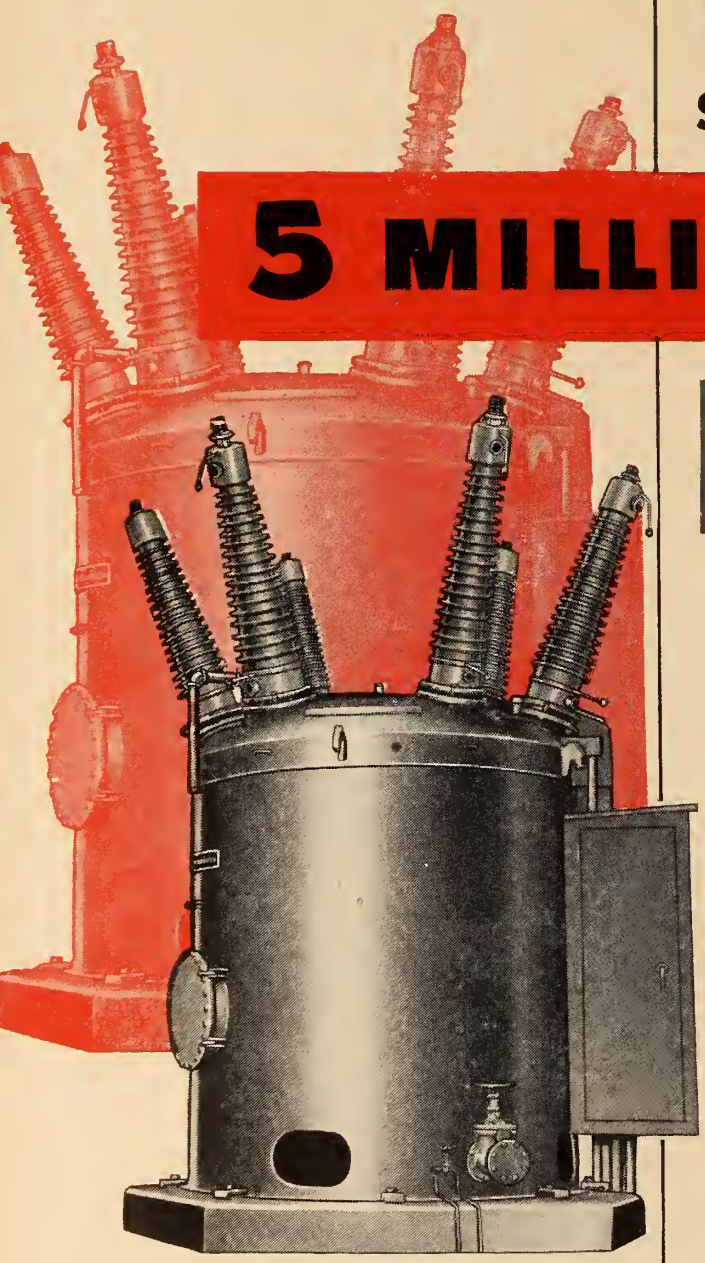

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The Mackenzie King Bridge, Ottawa

by

V. S. Thompson, M.E.I.C. *and* J. E. Bright, M.E.I.C.

Bridge Engineer *Engineer*

Department of Public Works, Ottawa

In the Preliminary Report entitled "Plan for the National Capital", prepared by the National Capital Planning Service, under the direction of M. Jacques Gréber, M.E.I.C., and published in 1948, the bridge over the Rideau Canal between Elgin and Waller Streets is described as "the first operation recommended to relieve downtown traffic." This bridge, subsequently honoured with the name of the late Prime Minister of Canada, is the subject of the following article.

Design

In 1947-48, preliminary designs were prepared by the senior author, at the request of the National Capital Planning Service. These designs were based on the idea of having a large municipal building at the east end of the proposed bridge. It is not proposed to enter into a discussion of all the factors involved in the decision to forego this development. Suffice to say that it was finally decided to proceed with the bridge as a traffic artery only, and to disregard any influence which such area planning might have imposed on the layout of the structure.

The conditions laid down, therefore, can be summarized as follows:

(a) The roadway must provide for at least six lanes of traffic, three in each direction to conform to the capacities of the feeder one-way streets.

(b) Approach grades must not exceed 3 per cent.

(c) The presence of the existing train shed past the end of which

Fig. 1. View of Mackenzie Bridge, showing Rideau Canal in middle foreground, with railway tracks leading to Union Station immediately beyond.

the bridge deck crosses, permitted a reduction of statutory railway clearance from 22 ft. 6 in. to a figure not less than that provided by the existing structure. The minimum clearance thus provided at this point is 18 ft. 3 in., which was of considerable help in keeping the deck elevation down and still providing for the haunch on the concrete beams.

(d) All construction must be carried on with minimum interference with railway operations on the 23 tracks over which the bridge passes.

(e) Canal traffic must be provided with a certain minimum clear channel during the operating season.

(f) Vehicle traffic on the Driveway and Nicholas Street, including street cars, must be diverted for a minimum period. Some leaway was granted in connection with this condition, and except for the week of the Ottawa Exhibition in 1950, no added difficulties were caused the contractor on this account.

(g) Finally, it was obvious to all concerned that the finished structure must in no way adversely affect the character of its surroundings. Even without the honour of being the first tangible postwar development of the National Capital Plan, and a memorial to a great Canadian, the location is such that it would be hard to find a bridge of equivalent size which could arouse more criticism if displeasing to the eye of the general public.

The Mackenzie King Bridge, first tangible postwar development of the "National Capital Plan", was commenced in April 1950 and opened for traffic late in 1951. Listing the conditions laid down for its development, the following paper discusses the design, methods of construction, and many of the problems encountered, concluding with a description of the organization set-up for undertaking the project and a list of those responsible for carrying it out.

It will be seen (Fig. 1) that the design is purely functional, the only concession to ornament being the fluted columns (Fig. 2) and the panelling of the faces of the abutments. It would be reasonable to describe the structure as consisting of three separate components, which will be referred to throughout this article as follows:—

(a) *The Canal Crossing* (332 ft. 0 in. in length) (98 ft. 6 in., 135 ft. 0 in., 98 ft. 6 in.). This is a three span continuous concrete structure which crosses the present Driveway, the Canal, and the four passenger tracks immediately adjacent to the latter. Because this portion of the bridge is skewed, and is also on a grade for part of its length, the geometry of each girder had to be worked out separately. Great care was taken to ensure that the soffit curves of the girders were accurately formed, and the contractor was provided with vertical ordinates at 7 ft. 0 in. centres for each girder.

(b) *The Railway Yard Crossing* (588 ft. 0 in. in length on centre line). A series of continuous structural steel deck girders divided into three sections of four - 50 foot (approximate) spans each. This portion will eventually be concealed from view by landscaped earth banks when the present railway station is moved to the new location called for in the National Capital Plan. It is expected, at that time, that the enclosure under the structural steel will provide a centrally located vehicle park.

(c) *The Nicholas Street Crossing* (157 ft. 6 in. in length). A three-span continuous concrete frame (47 ft. 6 in. - 62 ft. 6 in. - 47 ft. 6 in.)

Fig. 2. View from railway right of way, showing Canal span. Note fluting of concrete supporting columns.

Foundations

Borings taken by the Boring Division of Public Works Department previous to construction showed that rock was at a maximum of 28 ft. 6 in. below ground surface, varying from this depth in the railway yard to 3 ft. 6 in. on Nicholas Street. Most of the site was filled ground, having been previously used as a turning basin for Canal traffic. It was originally intended to excavate for all piers inside wells or caissons, and work was started on this from the east end, using wood sheathing. However, the two northern piers on line 18 were troublesome owing to soft sand and water causing cave-ins, and after completing the piers on lines 14, 15 and 16 by this method, it was decided to use Franki piles for the remaining piers.

Exceptions were in the freight shed, where the roof and floor over the piers would have had to be removed to accommodate the pile driving equipment, piers on lines 4 and 5, and those under Nicholas Street bridge, where rock was fairly close to the surface.

Excavation for line 4 (the five piers west of the Canal) presented no undue difficulty. As the retaining wall on the east side of the Canal showed signs of movement outwards, the piers on line 5 were redesigned to act as buttresses. They were built 10 ft. x 6 ft. at the bottom, tight against the wall, stepping up to 6 ft. x 6 ft. at the top.

The columns were placed on these piers just clear of the wall. The centre pier of line 6 passed through the side of a 3 ft. x 4 ft. sewer. A heavily reinforced concrete beam, varying from 3 ft. to 5 ft. in width by 4 ft. 6 in. in depth, and carried on four Franki piles, was built to carry the column over the sewer. Three piles carry approximately 90 per cent of the load, the remaining 10 per cent being on the fourth pile. The other columns in this line are carried on three Franki piles each.

In the freight shed, where excavation had to be carried out inside caissons for the reasons mentioned above, a lot of trouble was encountered, due to the infiltration of water from the canal, carrying with it silty sand which was difficult to control.

Borings taken on each side of the freight shed had shown, on the west side, soft grey clay for the last nine feet above rock in one hole. Stiff clay and fine gravel for eleven feet above rock was found in the second hole. On the east side there was found to be clay and fine gravel at the bottom, hard-packed coarse gravel for four feet, and nine and a half feet of stiff grey clay above that again, with seven feet of packed sand and fine gravel on top. These borings were taken in the winter, and there did not appear to be any indication of quicksand.

The small three foot or four foot diameter caissons were adequate when excavating for most of the piers. When the so-called quicksand was encountered under the freight shed, however, the small diameter of the excavation was a disadvantage. Boils occurred, and although the fine silty material and water could be pumped, it was hard on the pumping equipment. It was found that if the excavation were left for a day or so, the boils would heal up and fair progress could be made until the boiling started again.

Attempts were made to use wellpoints and to stabilize the material with cement, but with no success, the smallness of the caissons being a great handicap. Large boulders encountered interfered with the driving of the caissons, and of course the removal of the boulders meant a large welling-up of quicksand. That the Canal was responsible for a large part of the trouble is shown by the fact that excavation was easier after it had been unwatered in the fall of 1950.

Specification required that all caissons or piles be driven to bedrock, and particular care was taken to insure that such rock, where so exposed, was free from fissures before authorizing continuance of the work. In the course of excavation, some large boulders were encountered. This fact also was a cause of careful examination of rock bearing. In the case of Nicholas Street, it was necessary to lower the existing street railway tracks some two feet to provide the necessary clearance under the new bridge.

It was decided to leave this excavation until after the completion of the concrete span, so that the supporting falsework would get the benefit of the existing firm right-of-way. After the completion of this portion of the bridge and the removal of the shores, excavation work proceeded. In addition, a deep trench was dug immediately to the east of line 19 under the west sidewalk of Nicholas Street.

During the spring of 1951, a slight crack was noticed in one of the square columns of line 19. This crack ran horizontally across the column immediately below the beam haunch, and aroused suspicion that settlement had occurred. It was therefore decided to excavate down to bedrock, when it was discovered that what had apparently been solid rock at the time of pouring the column pier, was now badly fissured, with cracks in some cases having opened up to an amount of nearly an inch in width at the top.

It is believed this condition was caused by the deep excavation by the city close to the pier having permitted a concealed weakness to become apparent, through removal of the lateral restraint of adjacent rock. Undoubtedly this had been aggravated by blasting operations carried out at the time of the excavation of the sewer trench. It was, therefore, decided that the whole of line 19 should be consolidated by pumping in grout under pressure. This work was carried out under separate contract, and is believed to have insured that no further trouble on this account will occur.

Construction Joints

Considerable thought was given to the location of construction joints, particularly with the idea of avoiding unsightly cracks in the finished structure. An example of this line of reasoning is the following. It was originally intended to pour the full height of the north and south outside columns of all concrete spans in one operation. However, on consultation with the contractor, it was agreed that this presented him with too difficult a problem. A compromise was arrived at, which provided for the lower portion of the columns to be poured up to a horizontal line immediately below the lowest intersecting beam soffits.

The procedure in regard to the T-beams, which comprise the decks of the two concrete sections was as follows: Taking the simpler of the two structures first, viz., that over Nicholas Street, the stems of all T-beams were poured up to the line of the bottom of the 6 in. x 9 in. chamfer joining the stem to the slab. These stems, approximately 150 ft. long, were poured in one operation, including in each case a portion of the transverse concrete girder that ties these T-beams together. This involved the minimum number of bulkheads, and eliminated all construction joints in the stems themselves.

The transverse girder beams at the ends of the stems are designed to incorporate the 7½ in. deck slab. The intermediate transverse beams, on the other hand, are finished off at a line level with the tops of the beam stem, and are thus entirely independent of the one way slab action of the deck.

On completion of the stem pours, a powerful water and sand jet was employed to clean and roughen the tops of the stems, before proceeding with the slab pour. It will be understood that in this procedure timing is important — for example, the concrete must be sufficiently hard, but not so hard that the jet is unable to fulfil its function. It is believed that under ordinary conditions of moisture and temperature, the jet should be employed between 6 to 10 hours after placing the concrete.

This span was completed by pouring the slab in three operations, with a bulkhead running the full length of the structure down the middle of beam stems Number 4 and Number 6. The procedure involved a maximum yardage of some 240 cu. yds. of concrete in one day. Although this was performed with not too great difficulty, it was agreed that future pours should be reduced below this figure, if possible.

In the case of the larger span over the Canal, the principal feature was

the determination to eliminate any visible construction joint on the outside T-beams' stems. It was decided, therefore, to make the construction joints for these outside beam stems at one of the main supporting columns on the Canal. This somewhat unusual solution required the provision of special bulkheads at the columns concerned.

These bulkheads occur at the north column on line 5, and the south column of line 4. Stepped construction joints were provided for the 7 intermediate beam stems. The maximum yardage in any single day's pour by this method did not exceed 236 cu. yds.

As on the Nicholas Street structure, the stems of the Canal span were poured up to the line of the bottom of the chamfer between the stem and the 7½ in. slab. Instead, however, of sand-blasting the tops of the stems to provide horizontal shear resistance, shear blocks were inserted for half their depth in the wet concrete of the stem. Not only are the construction joints in the adjacent stems staggered, but the joints in the superimposed slab are also completely removed from the stem joints.

It will be noticed that the transverse joints in the slab itself are at points of maximum positive moment, thus insuring that there will be no tendency for these joints to leak after years of operation. No particular originality is claimed for any of the above procedures. The majority of them were forced on the designer by the unusual width of the structure. There was also the desire to avoid unsightly joints, which detract from so many otherwise attractive structures.

Concrete

Ready-mix concrete was used throughout in the structure, containing between 4 and 5 per cent of entrained air. Mixes were designed in the Public Works Testing Laboratory, and were adjusted to suit variations found to occur in the fine aggregate. Crushed rock of Ottawa Valley limestone was used for the coarse aggregate. Apart from the air entraining agent, no admixtures were used. Tests as to slump, air, temperature in cold weather, and compressive strength after 7, 14 and 28 days of curing under job and laboratory conditions were made of all concrete placed.

When cold weather set in little concreting was done, but during that time some heated concrete was supplied and steam curing for at least two weeks was carried out. Heating by means of oil burners was tried out in the case of the piers in the canal, but was found to be too dangerous. On two occasions fires broke out, endangering the large amount of falsework under the canal spans.

In curing the concrete during the warmer weather a sealing compound was used in some instances, but on the greater portion of the deck slab and on the surface of the construction joints burlap was used, saturated with water.

The slender heavily reinforced columns on line No. 6 were concreted in one lift up to the soffit of the girder. Fair results were subsequently obtained by carefully directing the concrete into the top of the forms and allowing it to fall freely to the bottom. A small amount of segregation occurred through striking the reinforcing, but not enough to weaken the column materially.

All piers were poured in the dry, although pumping had to be carried on right up until the moment of placing of concrete. Once having started the pour it was necessary to stop pumping, and to continue the placing of concrete and the vibrating as quickly as possible, to prevent an accumulation of water seeping through the caisson walls. The concrete used was very dry, having almost no slump. This condition, together with fast work, resulted in sealing off the water.

There was some apprehension as to what effect the nearby passing of trains would have on the concrete when setting. There was, however, no apparent cracking in the beams over the tracks, nor was there any appreciable motion in the structure when trains passed under it. This may have been due to the fact that the structure rested on rock and the vibrations from the trains on the overburden were damped out before they reached the bridge itself.

Electric and gasoline driven vibrators were used throughout, and on the heavily reinforced section over the canal no honey-combing

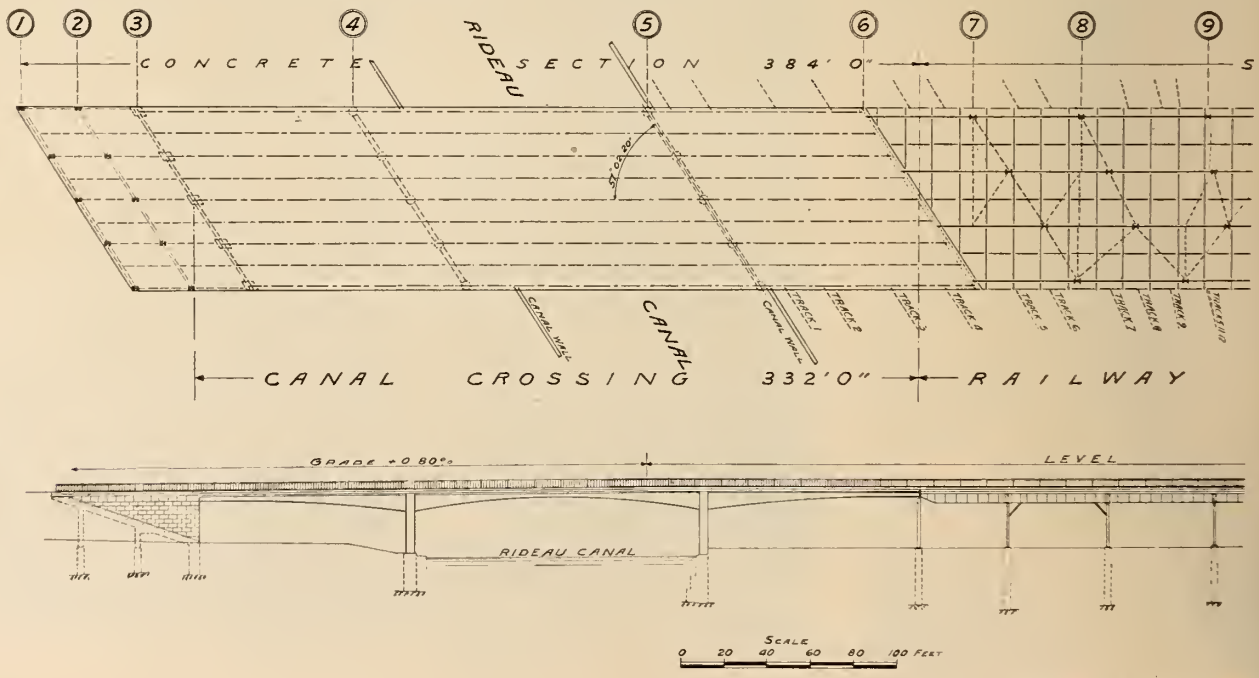


Fig. 3. Diagram showing bridge

whatsoever was found after the removal of forms, in either slab, beams, girders or main columns. This speaks well for the supervision of the concrete foreman.

Falsework

The removal of the falsework under the canal span was started one month after the deck slab above it had been placed. The supports were removed starting in the centre, and working both ways simultaneously. The dead load deflection was found to be less than had been calculated, which can only be explained by an increase in value of E_c over the assumed figure.

The shores supporting the concrete spans had to be tightened up every day, due to arching effect as the concrete set and cured, to shrinkage in the timber falsework, and to settlement in the bearing area under the falsework. Settlement amounted to little or nothing, as the shores either rested on the undisturbed Driveway or consisted of timber piles driven to rock in the canal.

The east span of the canal crossing required special falsework, in order to maintain railway traffic on the four-passenger tracks while the girders were being poured. This was arranged by employing nine of the 50 ft. steel girders braced with floor beams, the girders themselves being supported on wooden bents resting on the passenger platform. This proved to be a satisfactory solution, except for some inevitable delay in continuity of steel erection. It was arranged, of course, that the girders thus employed were to be the last ones erected, and this delay was therefore not too serious.

Welded Steel Girders

When the original design was prepared, it was intended to employ all Canadian materials by welding the 5 ft. deep girders from three plates. At the time of letting the contract several factors caused this plan to be abandoned. Perhaps the principal one was that exchange restrictions were no longer in force and it was possible to buy large T's cut from wide flange beams. The girders were therefore made up of 2-18 in. T's at 75 lbs. (cut from 36 in. wide flange at 150) and a 26 in. x ⅝ in. plate, with continuous butt welds between the stems of T's and the edge of the plate.

In view of the increased public interest in welded bridges, this design was submitted to Mr. R. M. Gooderham, director of the Canadian Welding Bureau, whose advice was freely given and gratefully received.

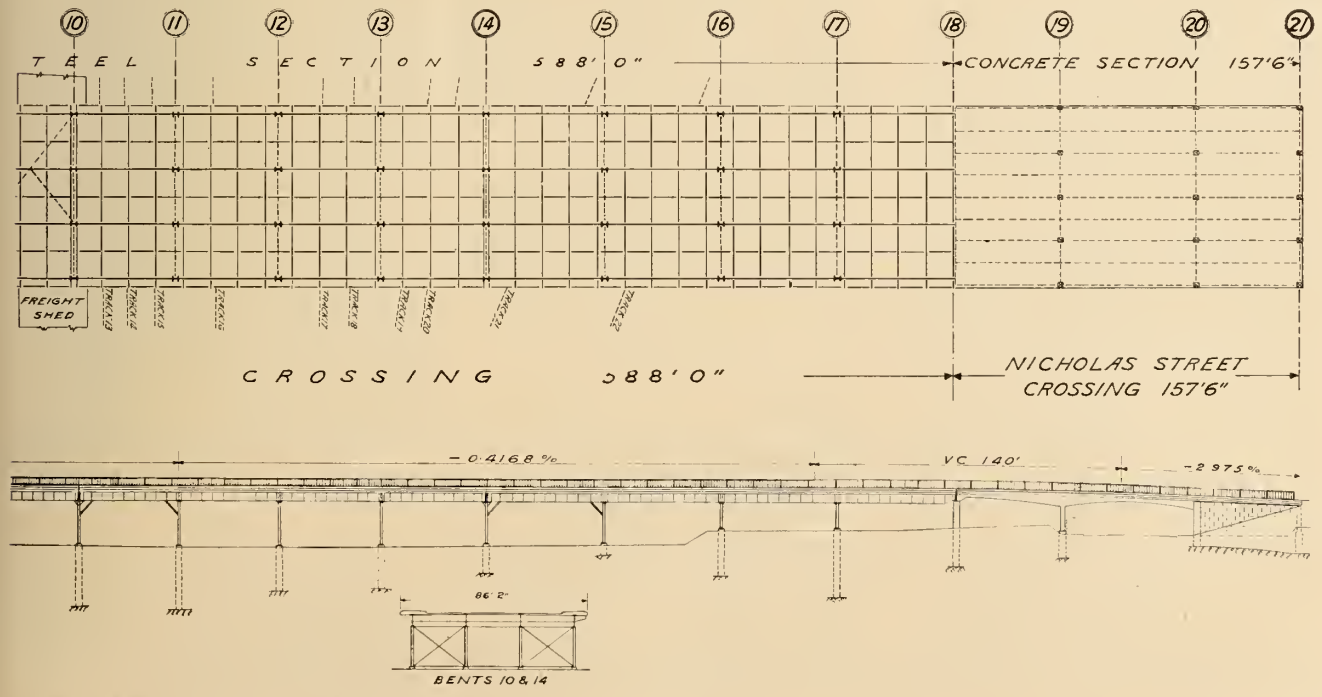
In addition to this, specimens of the welded sections were submitted to all possible tests by the Physical Laboratory of the Department of Mines, in Ottawa. The final appearance of the continuous weld is satisfactory, and it is felt that the girders represent the best modern practice.

Contrary to the usual custom, the splices of these continuous girders are placed over the supporting *columns* and not at points of contraflexure. The reason for this procedure was again influenced by the necessity of maintaining normal operating traffic on all the tracks in the railway yard during erection.

The columns in the majority of cases being mere rockers, any alternative arrangement of splices would require falsework on railway right-of-way, which would more than offset the slightly increased cost of splices at points of maximum negative moment of welded girders. All field splices were rivetted.

The four lines of longitudinal steel girders are spaced at 25 ft. centres. They are connected by transverse floor beams (30 in. wide flange at 180 lbs.) at 12 ft. 6 in. centres. Intermediate stringers (15 in. I at 42.9) connect the transverse floor beams, thus enclosing square panels with a side of 12 ft. 6 in. The 7½ in. concrete slab which fills these panels is designed with two-way reinforcing.

As is the case with all continuous structures, the degree of difficulty encountered in erection is increased by extreme temperature variation. The weather during erection was very warm, with much sunshine acting directly on the naked steel girders. The expansion was thus, as



elevations and structural details in plan.

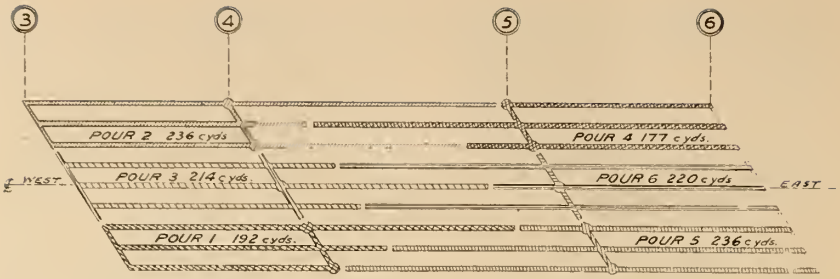


Fig. 4. Diagram showing arrangement of concrete pours for concrete beams and girders in Canal section.

would be expected, greater than will subsequently be experienced now that the concrete slab is in place. In spite of this, however, no great difficulty was encountered in splicing the different sections of the continuous girder over the tops of the columns. This was due to the fact that the latter act as rockers where they are intermediate supports.

It was considered better to leave a two-inch space under all steel bearing plates for final grouting, rather than to bring the concrete right up and around the plates. Air tends to get trapped underneath, and shrinkage of the setting concrete reduces the bearing considerably. The tried and true method of using dry grout rammed in tightly under the plates gave a most satisfactory job.

Bracing

Longitudinal Bracing

It will be noticed that the steel portion of the structure is completely free of normal diagonal braces, and that these have been replaced by a series of knee braces, which themselves are limited to one bay only of each four span section. This situation was forced on the designer by the railway layout, and is not considered too disadvantageous in view of the great width of the structure.

It is believed that traction forces will distribute themselves laterally through the agency of the roadway slab acting as a horizontal girder, thus the apparently inadequate knee bracing is sufficient for its purpose.

Horizontal Bracing

In the westerly portion of the steel structure, where the columns are skewed to the centre line of roadway, a system of horizontal bracing ties the tops of all these columns together, whereas in the remaining two sections of four spans each, viz., from line 10 to 14 and 14 to 18, no horizontal braces are provided. Complete reliance has been placed on the horizontal girder action of the concrete slab previously mentioned. This decision has again apparently been justified by the action of the structure under load.

Transverse Bracing

The steel columns at lines 10 and 14 are braced transversely, in the normal manner, with diagonals and struts. This represents the only transverse bracing in the structure, all other transverse forces being transmitted to the ground through portal action in the concrete supporting columns.

Expansion Joints

Expansion joints of the finger type are provided at the following points: line 3, line 6, line 10, line 14 and line 18. In the case of the Canal crossing, while both ends of the concrete spans are free to move, there is no mechanical provision made for temperature in the 135 ft. centre span. The effect of this is that the centre span of 135 ft. acts as a rigid frame for both L.L. and temperature. This, of course, has been taken into account in designing the columns.

On the Nicholas Street crossing no mechanical provision for expansion is made, and careful inspection for cracking after one hot summer and the unusually cold winter of 1951-52 has justified this decision. The ends of the concrete T-beams in the side spans of the structure are deeply haunched, and a plane of weakness is provided at the top of the stems on lines 18 and 21 to take care of excessive temperature stresses.

Abutments

The west abutment is designed as a self-supporting reinforced concrete structural frame of beams and columns, through which the approach fill is allowed to spill and assume its natural angle of repose. The structure is enclosed with a concrete wall; the north and south faces of which are provided with stepped ledges for the support of stone facing. The east face, running parallel to the Driveway, is divided into recessed and bush-hammered concrete panels framed in stone.

It was originally intended to employ Queenston limestone for this purpose but, on the advice of the Architectural Board, this was changed to Stanstead granite, and although the contrast between this expensive stone and the structural concrete of the bridge girders is quite apparent, the effect of time will, it is expected, soften this to a satisfactory combination.

The simulated east abutment, which is merely an enclosure of the most easterly span of the Nicholas Street crossing, is constructed in the same manner, except that the backing walls are of concrete blocks instead of being poured on the job. The space enclosed is utilized for the accommodation of the Federal District Commission equipment, tools, etc. and an arched doorway is provided in the north side of the abutment wall.

Sidewalk Slabs

The original design called for a precast sidewalk 3 in. thick, made up in panels 5 ft. long and 3 ft. wide, of 4,000 lb. concrete. The 7½ in. roadway slab is continued under-

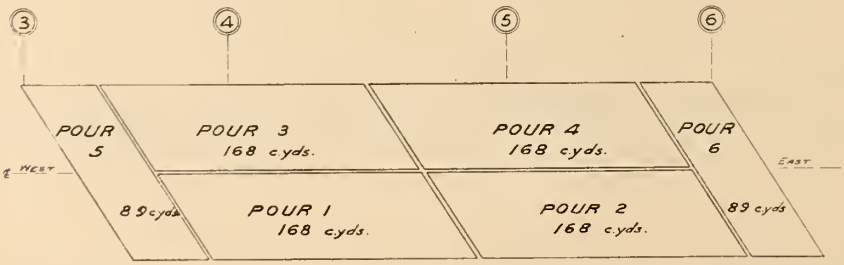


Fig. 5. Diagram showing arrangement of concrete pours for floor slabs in Canal section.

neath the sidewalk, and this procedure presents several advantages.

In addition to simplifying the pouring of the roadway slabs, and providing a future deck for traffic if it were ever considered necessary to widen the present roadway, the slab also provides a firm base for the utility ducts between it and the superimposed sidewalk slab. These ducts number eight for the use of the Hydro, and an equal number for the Bell Telephone Company the two utilities being on opposite sides of the bridge to prevent any interference.

The concrete curb and fascia beam were not poured until after removal of all falsework supporting the main girders, thus eliminating any beam action in these features from dead load deflection. In addition, they were poured in alternate longitudinal sections. Both curb and fascia are tied to the 7½ in. slab by means of bent rods, inserted in the wet slab at the time of placing.

A transverse bulkhead 4 in. wide, connecting the curb to the fascia at 5 ft. intervals along the length of the bridge acts as a support for the edge of the S.W. slab. This bulkhead is part of the low strength concrete used to surround the fibre ducts to protect them from moisture or physical damage by impact.

The poured in place sidewalk slab was grooved into 5 ft. x 3 ft. panels, to give the effect of the originally proposed precast panels. These grooves were later filled with sealing compound as they present an obvious entry for moisture. The sidewalk slab was given a wood float finish, and the general effect is considered preferable to the wide square panels of the ordinary city sidewalk.

The fascia beam 1 ft. 6 in. in width and 1 ft. 3 in. in depth, which also supports the handrail posts, is intended to provide continuity between the concrete structures and the steel viaduct. It is of constant dimensions throughout, and is finished on the exposed surfaces with an aggregate containing granite chips, with the idea of matching as closely as possible the Stanstead granite on the abutments. After removal of forms, these surfaces were ground to a smooth finish and the general effect is quite satisfactory.

Drainage

The large superficial area of the bridge deck, combined with the railway activities, passenger platforms, etc., beneath, and the fact that a large section of the structural steel portion of the bridge is on a level grade, all added up to a more complicated drainage problem than is usually presented in bridge construction.

The approach spans of the bridge on rising grades can be taken care of by means of catch-basins at or near the ends of the structure. It was necessary, however, to provide troughs across the total width of the structure at the expansion joints, and down-spouts to catch basins connected to sewers in the railway yard.

In the first winter's operations, it was felt advisable to provide a method of heating these down-spouts, as well as one of the transverse troughs which passes directly over a length of passenger platform. These refinements will, of course, not be necessary when the railway facilities are removed to a new location, as visualized by the development of the National Capital Plan.

A series of manholes suspended from the structural steel portion has been provided for the benefit of the utilities whose conduits cross the bridge. These were part of the structural steel contract. They are provided with wood floors and asbestos siding, and covered with a removable slab which forms part of the bridge sidewalk.

Lighting

Illumination is supplied from single pendant-type luminaires, suspended from brackets mounted on steel standards, located at the curb line. These standards are 90 feet apart and are opposite. The lighting intensity on the road surface of the bridge is of the order of 1.5-foot candles, which is higher than the minimum required for first class lighting.

The luminaires are supplied from 115/230 volt 3-wire circuit, carried in 2 in. galvanized rigid conduit, with transformers at each end of the bridge. Each transformer feeds the luminaires on both sides of the bridge to a point half the way across, and they are controlled by time switches with astronomic dials.

Acknowledgements

It may safely be said that the conception and construction of the Mackenzie King Bridge is a tribute to the large group of officials who have co-operated in this effort. The funds for building the bridge were taken from the annual allotment payable to the Federal District Commission from the Government of Canada, for the purpose of implementing the National Capital Plan. The contract was carried out on behalf of the Commission by the Federal Department of Public Works.

The location of the bridge was recommended by M. Jacques Gréber, M.E.I.C., who was retained by the late Mr. Mackenzie King himself. M. Gréber is adviser to the National Capital Planning Service, which comes under Mr. E. P. Murphy, M.E.I.C., Deputy Minister of the Department of Public Works.

M. Gréber's recommendation was approved by the Federal District Commission, the chairman of which at that time, was the Honourable Frederic E. Bronson, M.E.I.C. Mr. Bronson took an active interest in the design and construction of the project, and both he and the chief engineer of the Commission, Mr. Alan K. Hay, M.E.I.C., have played a large part in its successful completion.

Although not with the Department of Public Works at that time, the designing engineer was given every assistance by the chief engineer, Mr. Robert Blais, M.E.I.C., Department of Public Works, and his staff.

In April 1950, the main contract was awarded to E. G. M. Cape and Company, of Montreal, and was carried out under the supervision of Mr. W. D. Kirk, M.E.I.C., chief engineer and the company's resident superintendent Mr. R. F. Sadler, M.E.I.C. The principal subcontractor to this firm was the Central Bridge Company.

The Mackenzie King Bridge was opened to traffic on December 8, 1951, by Her Worship Mayor Whitton, in the presence of Mr. Duncan K. MacTavish, O.B.E., Q.C., chairman of the Federal District Commission. It is a source of regret to all connected with the project that the man in whose honour the structure is named did not survive to officiate at the opening ceremony.

The authors of this article acted in the capacities of engineer-in-charge and resident engineer during the entire period of construction. Mr. Bright was ably assisted by Mr. A. S. Schechter, S.E.I.C., who also carried out most of the instrument work. Mr. G. R. Evans, M.E.I.C., contributed much to the planning of the project, as did also Mr. Geo. H. Foures, who checked the stress calculations, and Mr. D. A. Symon, who made most of the drawings. Mr. E. Viens, M.E.I.C., internationally recognized for his work as former director of the Public Works Testing Laboratory, rendered valuable assistance in the designing of the mix and placing of the concrete. √

Fig. 1. The Red River in flood, City of Winnipeg.

Economics of Flood Disasters

by

J. B. Carswell, O.B.E., M.E.I.C.

Consulting Engineer—Vancouver, B.C.

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

This paper deals with the question of who should bear the costs of reconstruction resulting from major flood disasters, and how to minimize them. Discussing methods of controlling further building on lands subject to flooding, the author advocates the setting up of provincial authorities which will define the danger areas, and refuse building permits thereon, thus limiting the continuing growth of potential damage.

During the last decade, the flood frequency of many rivers on the North American continent has been definitely changing for the worse. The reason for this is obvious. Mr. William Vogt, in his well known book "Road to Survival", gives a vivid exposé of how we on this continent, together with other nations scattered all over the world, are slowly destroying our own food supply, and at the same time creating flood conditions. Civilization is steadily creeping across the earth's surface, destroying the forests and denuding the plains of their natural vegetation. Hence, year by year the danger of flooding steadily increases.

The general public are fully conscious of flood disasters. One might almost say they are very interested in them. Nothing seems to stir the public more than to read in the press, with rising tension, of the oncoming of a flood. We have here a dramatic background, a feeling of helplessness. The newspapers play up the human side of the tragedy, until one can almost see the silt and slime on one's own rug as the dreaded waters recede. A great fire, a railway disaster, a crashing aeroplane, strike the headlines for one brief moment, and then are gone and forgotten almost as quickly. A flood situation however, stays in the news day after day. Behind it all is a certain silent criticism of the engineer—why can't these things be prevented?

No Mathematical Approach

As one engineer who has been close to some recent flood disasters, I would say that there is no clear-cut mathematical approach to the prevention of floods. The ever-changing surfaces of the watersheds, and the thousands of permutations and combinations handed to us by the vagaries of the weather, leave only a

broad empirical approach to the problem. To prove this, one has only to look at one of the most recent flood disasters, down in Kansas City.

The Corps of Engineers for 40 or 50 years have kept a careful record of a small tributary running into a large river, and consistently for all these years the little river and the big river behaved normally, even in flood time. Suddenly, for reasons which so far have not been divulged, the little river became the big river, while the big river became the little river, destroying completely the dyking defences of the area, and causing a disaster running into hundreds of millions of dollars, with all the grief and disturbance which goes with such disasters.

Right here in our own province, a fairly accurate record of the Fraser River had been kept for close on 50 years. One very bad flood took place in 1894, and the next major flood took place in 1948, 54 years later. When this last flood was over, and we were faced with the problem of justifying certain capital expenditure in the Valley, it seemed quite sound to work on a frequency of 1-in-54.

However, two years later, in 1950, the Fraser again rose to within 6 inches of the level of the disaster flood in 1948, changing the frequency to 1-in-28. In passing, I may say that we were extremely fortunate that the river did not decide to come up again in 1949, when half of the new dykes were built and the other half did not even exist.

On a "cost-benefit" ratio as worked out in great detail by the Corps of Engineers, we felt justified in spending $10,000,000 on reconstruction in the Fraser Valley. If we had prepared the same calculations two years later, in 1950, we would have been justified in spending at least twice that amount of money; hence I repeat, there just is no mathematical approach to the spending of money on flood protection, either before or after a serious flood.

Compromise at Winnipeg

Again, in the City of Winnipeg in 1950, as all who read the newspapers know, the Red River started to creep up slowly, but unlike the boisterous Fraser, the Red River gave us weeks of warning. In reality, little could be done during these weeks. They simply became weeks of tension,—of wondering whether the weather would be good to us or not.

In the past 125 years Winnipeg had experienced many minor floods caused by the Red River and the Assiniboine. In 1948 they had a fairly bad flood, but the frequency of floods of disaster proportions in Winnipeg remains today at 1-in-125. This presented another curious economic problem. While the Red River was creating a frequency record of 1-in-125, at the same moment the Fraser River in British Columbia was cutting its frequency in two. Was the Red River likely to do the same thing, or would we be justified in building defences against a river which only caused disaster once in 125 years?

The solution we arrived at in Winnipeg was frankly a compromise. We built broad elevated boulevards up and down the banks of the Red River to a height that would contain, and a little more than contain, the 1948 flood level. These boulevards could at the same time be used as a base on which to build temporary dykes to contain the 1950 disaster levels. This we christened "an emergency system of dyke protection."

In Winnipeg my good friend and colleague Mr. D. M. Stephens stated very aptly that disaster floods in the Red River were caused by a combination of five weather conditions. To get all five conditions in one particular winter and spring, he observed, was as likely as a "royal flush" in a poker game. One had to have, first, an early and very hard frost in the fall before the snow arrived. Second, one had to have a very heavy fall of snow. Third, one had to have a very late spring. Fourth, one had to have extremely warm weather in the springtime—followed by the last card, heavy warm rains. So in Winnipeg we took precautionary measures against the "royal flush," and built fairly solidly against a "full house".

Are We Too Soft-hearted?

In 1948, the Fraser and the Columbia were both in flood at the same time. Nearly 600,000 cubic feet per second went tearing through the Fraser Valley, and on the other side of the same mountains, nearly a million cubic feet per second came tearing down the Columbia Valley. Humane and sympathetic as they are, Canadians set to at once to reconstruct the dwellings and other buildings that had been damaged, and to rehabilitate the farmers for their losses. By public subscription we raised enough money to put back all the damaged furniture and carpets—all the lares and penates.

On the other side of the line, the Federal Government of the United States set up small Branch Banks of the R.F.C. in the Columbia Valley, where the desolate farmers could borrow money at a low rate of interest! The only activity in common in the two Valleys was the excellent work of the Red Cross. However, in both Valleys the Governments stepped in at once to reconstruct the defences against a repetition of the flood.

Who Should Bear the Burden?

This leads us to the very broad question—who, in equity, should pay the cost of rehabilitation and reconstruction after a disaster flood?

Fig. 2. Examples of improvident settlement on the banks of the Red River, Fort Garry, Winnipeg.

J. B. Carswell (left), the author, and E. M. Proctor, chairman of the annual meeting session, at which this paper was presented.

When the Fraser went in flood in '48, the Premier of British Columbia appealed to the Prime Minister of Canada, and as a result Mr. Mackenzie King made a public statement that the flood had reached the proportions of a national disaster. The Federal Government forthwith stepped into the picture and paid three-quarters of the cost of reconstruction, leaving the Provincial Government to pay the other quarter. In Winnipeg in 1950, precisely the same thing happened. The province appealed to Ottawa, and Ottawa again declared the flood a national disaster and again donated 75 cents of each dollar spent on reconstruction.

One naturally asks the question—how often is this going to happen, and is it right and proper that the money paid by the taxpayer, say, in New Brunswick, should be paid out by the Federal Government to bail out some poor fellow in British Columbia?

Again, is there any mathematical formula which could be adopted by the Federal Government in measuring the magnitude of a flood disaster and which would enable it to say that when the damage reached a certain percentage of the provincial personal income, federal participation would occur, but up to that point no federal aid would be given.

There are many, many facets to this problem. Obviously the federal Government could not stand by and see a disaster loaded on the shoulders of a province beyond its financial capacity to bear. On the other hand, if a certain group of citizens are wilfully improvident in their settlement, it is questionable if anyone should step in to their aid. My own opinion is that the Federal Government can only size up each situation as it occurs, and mete out uniform treatment to the provinces.

The Case of Elm Park

There is a certain little peninsula in the Winnipeg district which is almost completely surrounded by the Red River. On the earliest survey maps of this district, this particular peninsula is marked "Bad Ground—Not Fit for Habitation". Yet 2 million dollars' worth of the finest homes of Winnipeg are built beneath the treacherous shade of the elm trees—in fact the area is known as Elm Park. The early settlers, living close to nature, undoubtedly knew that these beautiful elm trees in the middle of the prairie indicated a high water table and a dangerous place to build.

It might be argued that the city dweller of the 20th century would not know this, and could not be blamed for building his house on what turned out to be the flood-plane of the River. The destruction in this area in 1950 was really appalling. But the point I am making is that you and I paid for the reconstruction. If the inhabitants of Elm Park had been tried by a Court of Law for the offence of improvident settlement, and had been found guilty, then you and I should not have paid for the reconstruction.

This gets me back to the beginning, when I said that all good Canadians were very humane and very sympathetic in their approach to such problems. The fact is, we did pay for Elm Park, and I have yet to hear a word of objection. It would seem logical, therefore, to base any attempt to legislate against flood disasters on the premise that good Canadians will continue to be humane and sympathetic and generous when a disaster flood occurs.

Provincial Authorities Needed

In other words, it would seem necessary to legislate against repetition of calls on the generosity of the average Canadian citizen. If we don't, the worm will undoubtedly turn, and John Doe will get cynical, and tired of bailing out the other fellow, which would be in itself a fundamental tragedy. How, then, can we minimize the financial losses of future floods?

Flying over the Winnipeg area at the height of the flood, one was immediately struck by the sight of row upon row of *new* houses, some of them under construction, marching closer and closer to the riverbanks for all the world like truant children sneaking down to the forbidden waters. Our leading insurance companies, and, I regret to report, the Federal Government itself, were financing these operations.

In normal times these sites looked so attractive—amongst the shade trees and close to the river. I suppose the newcomers wondered why they hadn't been snapped up long ago. Did the old-timers warn them? Perhaps they did, but their warnings must have been treated as just so much gloomy hearsay. No one had ever seen a disaster flood on the Red River, and Sir Sandford Fleming's detailed description of one great flood in the early part of the last century was just history.

Yet these new houses were going up on the flood-plane of a river, creating a contingent call on my pocket-book and on yours, and no authority existed which could stop the operation. Before we finished in Winnipeg, six new houses were under construction on the wrong side of the new boulevards!

The lacking authority must in the first place be created by the provinces, but at the rate Ottawa is being stuck for flood relief I would think the Federal Government would be very helpful and co-operative.

Restrictive Legislation in B.C.

After the Fraser disaster, the British Columbia Government se-

riously considered new and restrictive legislation. Two steps were contemplated, but so far only the first step has been taken.

Each dyked-in area in B.C. is run by a local commission handling what is known as a Dyking District. The owners of the protected land are taxed so much an acre to cover the cost of maintaining the dykes and running the pumping stations during high water. In effect, the farmers are taxing themselves, which system led to deferred maintenance and straight indifference and neglect. Had these dykes been properly maintained, the two governments involved would have been saved many millions of dollars.

Today, by legislation, the Provincial Dyking Inspector has over-riding authority on the maintenance. If any district refuses or neglects to carry out obvious repairs, the inspector can step in and do the work himself, and the cost becomes a first charge on any monies flowing normally from the province to the municipality.

This first step is good, so far as it goes, but the second and much more difficult step is the real answer. This would give to the Inspector of Dykes an over-riding authority on the issuance of building permits in all areas where danger of flood exists.

In rural areas, such as the Fraser Valley, this would not be too difficult to operate. A farmer wishes to build a new barn. He obtains his building permit in the usual way from his municipal authority. Then the inspector steps in and says, "Not there, but here on higher ground." Seldom would an entire farm be within the flood-plane of the river. The farmer might object from his operating viewpoint, but such objection would have to be overruled.

Opposition From Urban Areas

But when we come to expensive city property or even suburban property, the minute we create the new authority, entailing, as it must, a definition of the areas in which the inspector operates, we cast a cloud on the titles of large areas of quasi valuable land. This is going to meet with frantic opposition from the landed interests, but I would argue that we, both as engineers and as taxpaying citizens, should fight to overcome this opposition.

After all, what we would be doing would simply be separating intelligently the wheat from the chaff. "This land will never be flooded, but that land may be." The average young Canadian about to build his first home would welcome such information, and at the other end of the line we would stop dead many a land sale bordering on the fraudulent.

Between these two extremes will lie a group of honest people who have innocently purchased land as a sound investment, and who would find their investment sharply depreciated. What to do about them would be a real problem, but in these days of ultra-benevolent governments, the problem should not be insoluble. In Winnipeg itself, the last flood very effectively defined the good land from the bad, and so far no Government action has taken place. We have been side-stepping this issue far too long in Canada. The longer we leave it, the more difficult will be the solution. Meantime we will go on paying and paying to bail out the poor flood victim. It may be that this unfortunate citizen will always be with us, but certainly we can stop *now* creating a new crop. √

Fig. 4 (above). Blocking off the Chilliwack River, a tributary of the Fraser, by earth dam and pumphouse.

Fig. 3 (below). Strengthening the dykes on the Vedder, a tributary of the Fraser River. Note the low-lying dwellings on the left.

Performance of Sawmill Headrigs

by

D. S. Smith

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

This paper reports on tests being carried out for determining the relative merits of various drives for headrig carriages used by the lumber industry. It shows how tests conducted by trained technical personnel can save dollars for an industry by demonstrating ways of speeding up the operation of equipment.

One of the important functions of the Research Department of an industrial organization should be the obtaining of quantitative data on operations, which will provide management with a basis for decisions on modifications to these operations. Whether the work is termed process or equipment research or operational research is partly a matter of definition, partly a matter of method of approach to the problem.

The study reported in this paper was initiated as a result of repeated questions from the lumber industry regarding the relative merits of various drives available for headrig carriages. It became obvious that preferences for one drive or another, while often based on long experience and mature judgment, were not supported by quantitative data such as could be obtained by making use of scientific measuring techniques.

The headrig in most sawmills makes use of either a band saw or circular saw to break down logs into cants or planks, which then pass on to edger or gangsaw for subsequent operations. At the headrig, the logs are loaded onto a carriage which runs on rails, and carries the log past the headsaw. In most cases cuts are made during the forward pass only, but in the case of double-cut rigs, cuts are made during both forward and return passes. The headrig is obviously the key to production of the sawmill unit, and increased production by the headrig is ever an object in view, so long as it does not interfere with the quality of the production and the efficient utilization of the logs.

The design of carriage drives has logically been aimed at providing rapid acceleration and deceleration, as well as relatively high return speeds (for single-cut rigs), since these represent the unproductive

D. S. Smith (right) author of this paper, is shown at the annual meeting with C. N. Danks, M.E.I.C., who chaired the session at which the paper was presented.

parts of the cycle. Speed of the log past the saw is limited by saw design and speed characteristics.

Types of Drives

A number of different types of carriage drives are at present in use, but still the most popular is the steam engine, which makes use of an endless cable and two sheaves, one at either end of the carriage track. Also in common use is the so-called 'gunshot feed', which uses a steam cylinder the full length of the carriage travel, and drives the carriage directly through a heavy piston rod.

These two steam drives have been most satisfactory. The fact that they were relatively inefficient was not an important factor when steam was being generated using waste from the mill itself as fuel. Now that much of this waste is finding a market as pulp chips, or as raw material for hardboard and other products, the inefficiency of these two pieces of equipment is coming under question.

Two other general types of drive are being used to a more limited extent. The first of these is the electric drive, generally of the type employing a motor-generator set for supplying d-c current to a variable speed d-c motor, which in turn drives the carriage through a cable system similar to that used by the steam engine. The other class of drive now coming into use is that which makes use of a variable speed oil drive.

Both these new types of drives have the advantage of relatively high efficiency. In the case of the electric drive at least, there is the additional advantage that regenerative braking can be used, and this further reduces energy consumption. There are still other drives, some old, some new, which may find application particularly in the smaller mills.

A preliminary study of the problem indicated it would not be wise to restrict a study to the carriage drive only. It was decided that the scope of the work should be expanded to cover all the operations at the headsaw, which would include the loading, turning, setting and unloading operations, as well as the sawing and carriage operations. The objective of the work was finally set out as follows:

1. To study the cycle of operations at the headsaw, and find those operations which could most profitably be modified so as to shorten the sawing cycle. This information is of interest to users and manufacturers alike.
2. To compare the performance of different types of equipment used for the same operation. This is an ultimate objective and cannot be achieved until tests are run at several mills.
3. To show how existing equipment can be used to best advantage.

To date, a single series of tests only has been carried out, and these tests were conducted at the New Westminster Mill of the Alaska Pine Co. Ltd. The carriage under study is full electric and dogs have a 54-inch maximum opening. The gunshot cylinder is 14 inches in diameter, and steam pressure during tests was 130 psi (increased since that time to 140 psi). Control of the valve for the gunshot drive is through a direct mechanical linkage. Maximum length of log normally handled in this mill is 20 feet. Log turning is done with a standard nigger.

Test Equipment

Performance of the carriage drive was studied by using a d–c tachometer generator feeding into a Brush strip-chart recorder to yield a speed-time graph. After considering various means for driving the tachometer generator, it was decided to mount a rubber-tired wheel on the generator shaft and run this wheel on the piston rod where it emerges from the gun-shot cylinder. In spite of the fact that the piston rod was both hot and oily, no difficulty was met with due to deterioration of rubber or to slippage. The generator was pivotally mounted and housed in a heavy protective casing to save it from damage.

In order to show the time required for the various functions performed at the headrig, a simple system was designed for introducing timing "pips" onto the speed-time record. The arrangement of the circuit, together with other test equipment, is shown schematically in Figure 6. Four microswitches, each with a normally open and normally closed contact connected in parallel, were provided at the test operators' position over the gunshot cylinder.

When the operating mechanism of one of these switches was either depressed or released, it momentarily introduced a d-c bias voltage in the tachometer generator circuit, by virtue of the fact that the switches are break-before-make type. Pips of two different magnitudes and of both polarities were used as follows:

Long pip up	— log turning
Long pip down	— setting
Short pip up	— obstruction resulting in stoppage
Short pip down	— loading

A speed-time record showing timing pips in reproduced in Fig. 1.

In order to indicate on the speed-time record the time occupied by sawing, a second Brush recorder was used for simultaneously recording saw motor current. The arrangement used a shunt resistor R_1 in the current transformer circuit (Fig. 6), and the voltage across R_1 was stepped up, rectified and fed into the recorder. Also introduced into this circuit were the loading timing pips, these being used to identify corresponding points on the two records. Fig. 1 shows a current record, and indicates how the beginning and end of the sawing period are identified and projected over to the speed-time record.

Identification of the end of the sawing period is made rather difficult by the oscillation in saw motor current. This oscillation is of interest, as it appears to be due to the shock load occurring when the log hits the saw. Its frequency of approximately one cycle per second is about what one would expect for a system comprising the motor rotor and high inertia band wheel. It seems possible that such an oscillation might help to explain as fatigue failures, some of the band saw shaft failures of the past.

Tests

Apart from a preliminary trial run to check the performance of test equipment, only one test run of about three hours' duration was carried out. During this period a record was kept of all logs cut, their approximate diameter and the depth of each cut. A regular sawyer was on the job most of the time, but some records were also obtained with a relief sawyer.

Equipment behaved well except for one of the recorders, which ran slow during the latter part of the run, and this made it impossible to analyse the later records. This problem will be simplified on future work, as it is planned to use a newly-acquired two-pen recorder instead of two separate recorders.

In carrying out the analysis of speed-time curves, somewhat arbitrary definitions had to be given to the various parts of the cycle. While

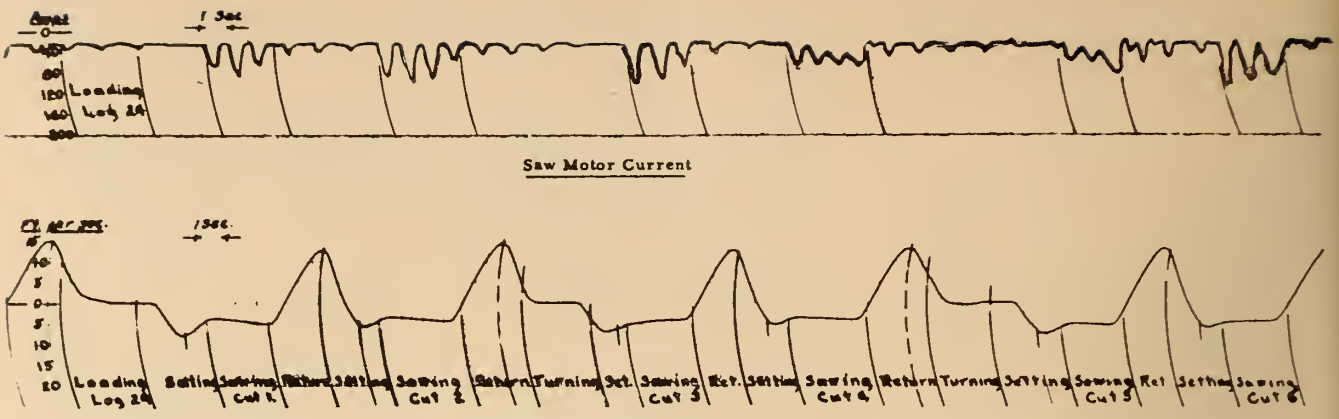


Fig. 1

these definitions might be questioned in some cases, they appear to result in a fairly good breakdown of time. The following are the definitions used:

Time available for setting:

1. Setting a new log — end of loading period to start of sawing period
2. Setting after turning — end of turning to start of sawing
3. Setting where turning not required — time at which log clears saw on return trip to start of sawing.

Safety margin before sawing — end of actual setting operation to start of sawing.

Sawing — period during which saw is cutting log as shown by motor current.

Carriage return time:

1. Return for new log — end of unloading until loading of next log starts
2. Return for turning — end of cut until turning starts
3. Return for new cut, no turning — end of cut until log clears saw.

Loading — Time from instant log loader starts to operate until dogs are in place.

Turning — Time from instant dogs start up until they are down again.

Unloading — End of sawcut to instant carriage reaches zero speed.

Time Breakdown for Two Groups of Logs

From the large number of logs sawn during the test period two series were chosen for detailed analysis, the first comprising thirteen logs varying in diameter from 15 to 30 inches and averaging 18 inches, the second comprising ten logs varying in diameter from 15 to 42 inches and averaging 28 inches. Time for each operation, for each log in the group was tabulated. This was summarized so as to obtain the average time required for each operation, the average number of operations of each type per log, and finally the percentage of time for each operation as part of the total for the log group. Percentage figures for the two log groups are given in Table I.

Table I—Percentage of Total Time Required for Each Operation

Operation	18-in. log group	28-in. log group
Setting	24.5%	23.4%
Sawing	32.3%	37.2%
Return trip	23.7%	21.7%
Loading	5.9%	3.8%
Turning	8.1%	11.4%
Unloading	5.5%	2.5%
Total	100.0%	100.0%

Analysis of a Typical Sawing Cycle

In order to gain some idea of the effectiveness of the present operation, and at the same time to investigate means of saving time during the cycle, a typical cycle has been analyzed in considerable detail. This cycle is the first cut on a 24 in. diameter log, a complete sawing cycle for which is shown in Fig. 2. It will be seen that breakdown of this log involved seven sawing operations and only two turning operations. Fig. 3 shows the return trip after the first cut, to a larger scale.

The following covers the stages of analysis of this cycle:—

1. The first move was to check the position of the "pip", showing the point at which the log leaves the saw on the return stroke by comparing the area under the curve on the return stroke with the area under the curve on the forward stroke.* Comparing these areas, it is found that the timing pip was introduced by the operator 0.2 seconds early, and point "A" shows the corrected position. The area ABC equals the area CEF. The error in introducing the timing pip is not an unreasonable one.

2. Consider now an alternative cycle, where the carriage is slowed down earlier on the return stroke. The new cycle is shown by the curve O′A′C′GE. This new curve is constructed by making the area O′A′B equal to the area OAB, and the area A′BC′ equal to the area GEF. In building up the new cycle it has been assumed that the time required for setting is unchanged, and that acceleration and deceleration rates are also unchanged. Making the area O′A′B equal the area OAB makes the distance covered on the return trip the same in the two cases and this, of course, is essential. Areas A′BC′ and GEF must be equal as they were in (1) above. It will be seen that the result has been to increase the cycle by 0.2 sec. which, in a cycle averaging about 10 sec. is about 2 per cent, a not inconsiderable time.

3. Having seen the effect of earlier slow-down on the return trip it seems desirable also to investigate later slowdown. This has been done by constructing a further alternative cycle (Fig. 4), using the same setting time and the same acceleration and deceleration rates, but providing for abrupt rather than smooth change from acceleration to deceleration. This will be called "an ideal cycle", although it is ideal from a theoretical point of view only. It would not be ideal from the point of view of the man riding the carriage, who would

*The area under the curve represents distance travelled. In mathematical terms the distance $S=\int v dt$ where v is velocity and t is time.

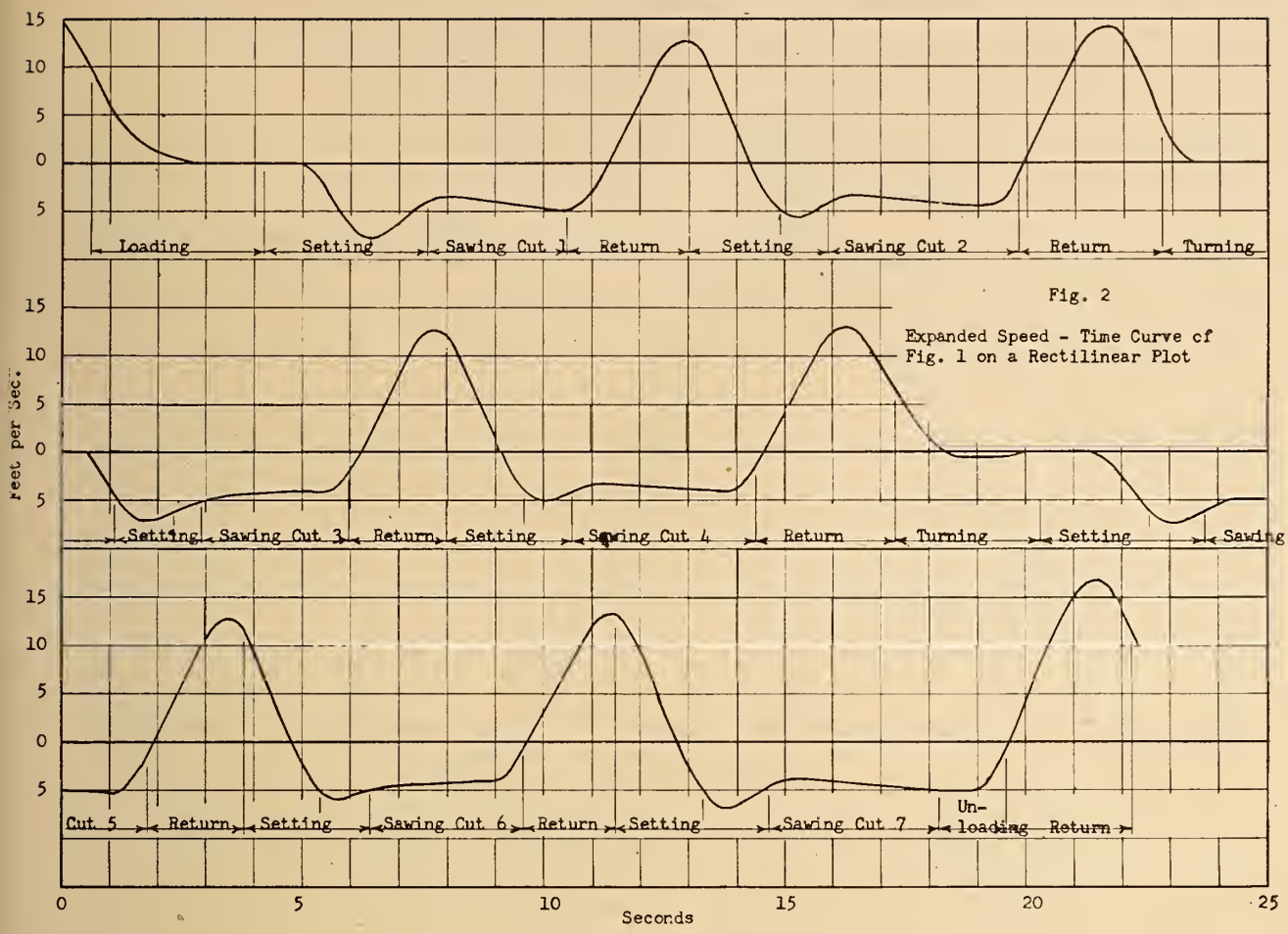


Fig. 2

Expanded Speed - Time Curve of Fig. 1 on a Rectilinear Plot

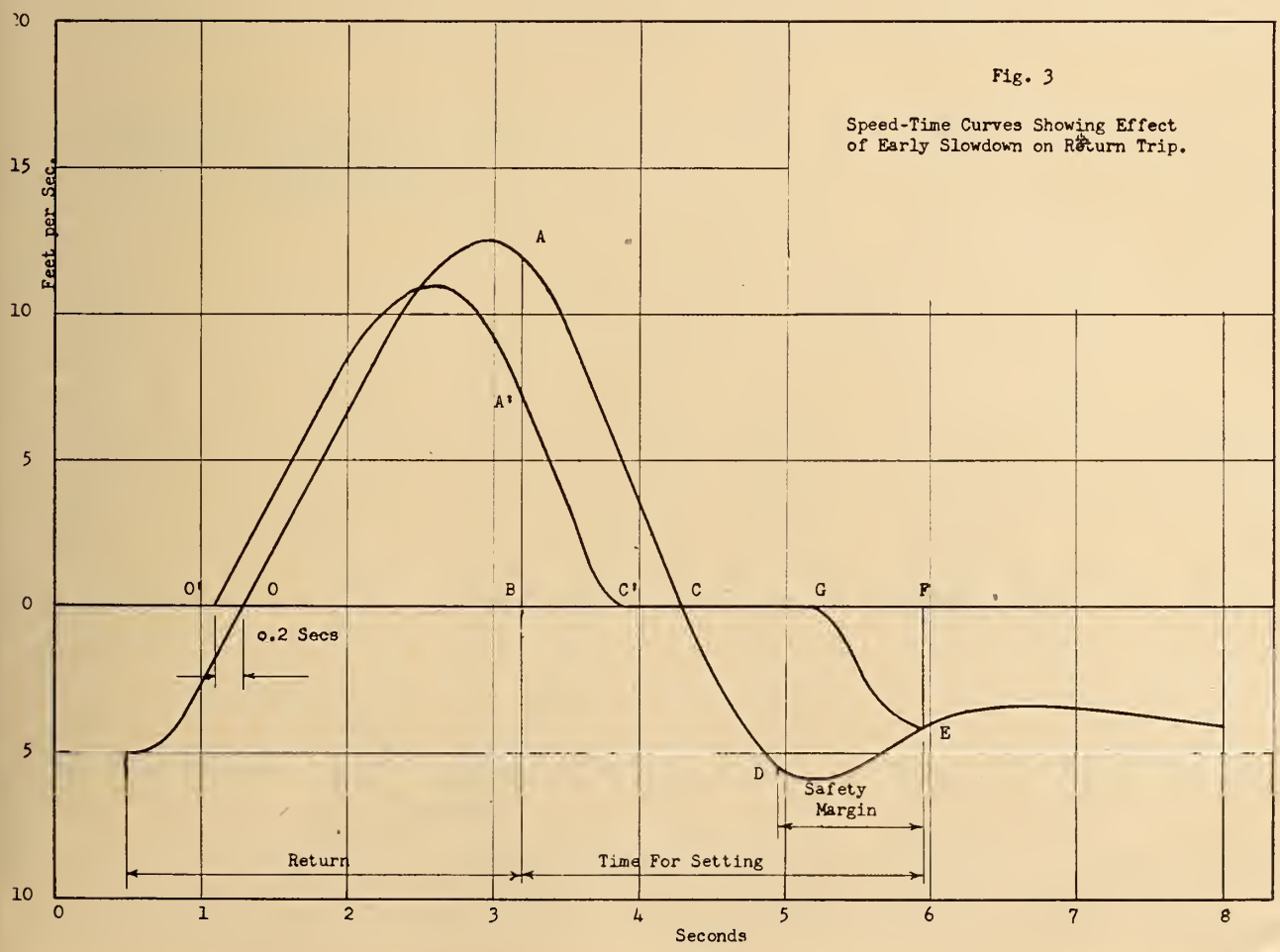


Fig. 3

Speed-Time Curves Showing Effect of Early Slowdown on Return Trip.

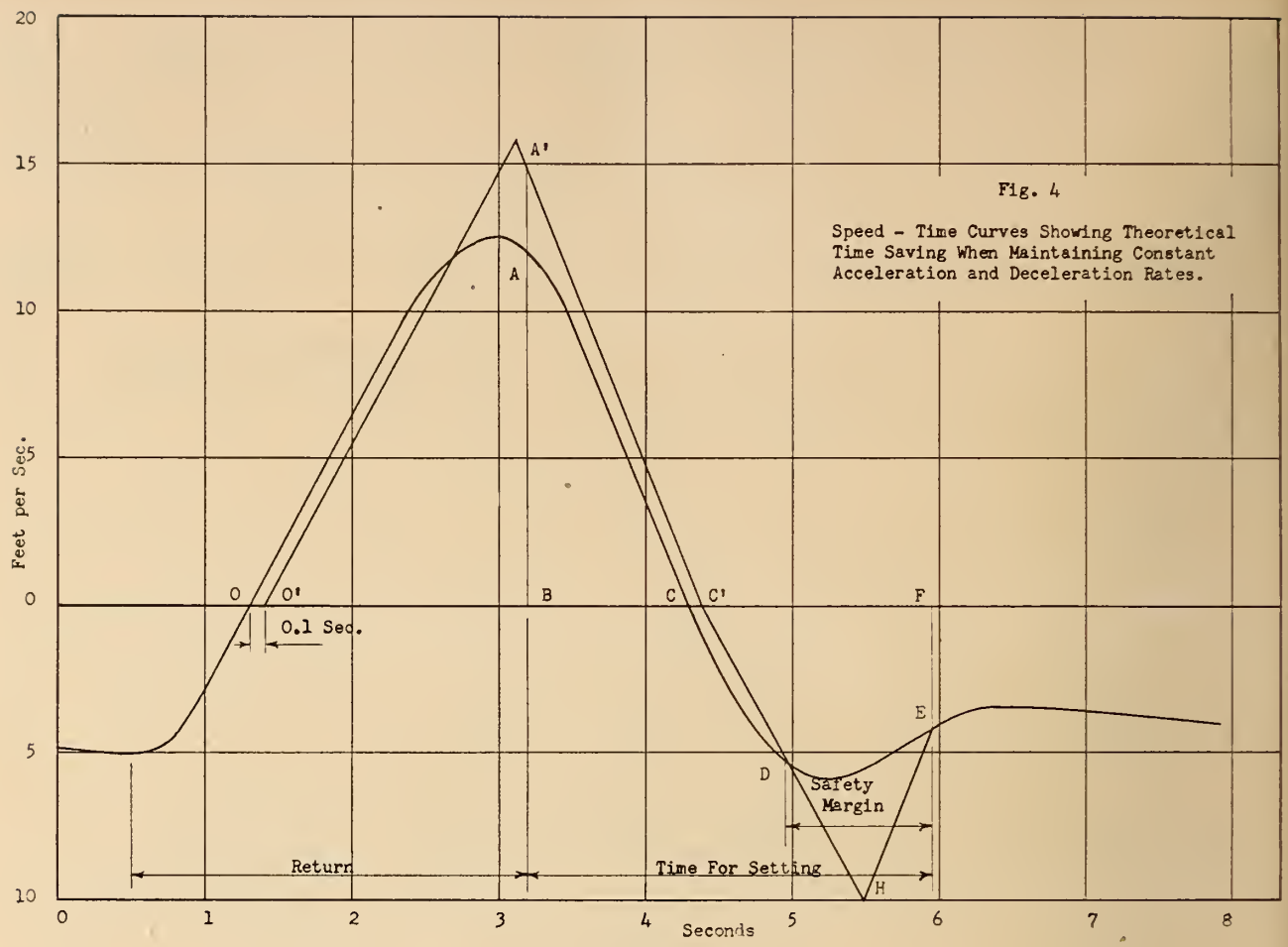


Fig. 4

Speed - Time Curves Showing Theoretical Time Saving When Maintaining Constant Acceleration and Deceleration Rates.

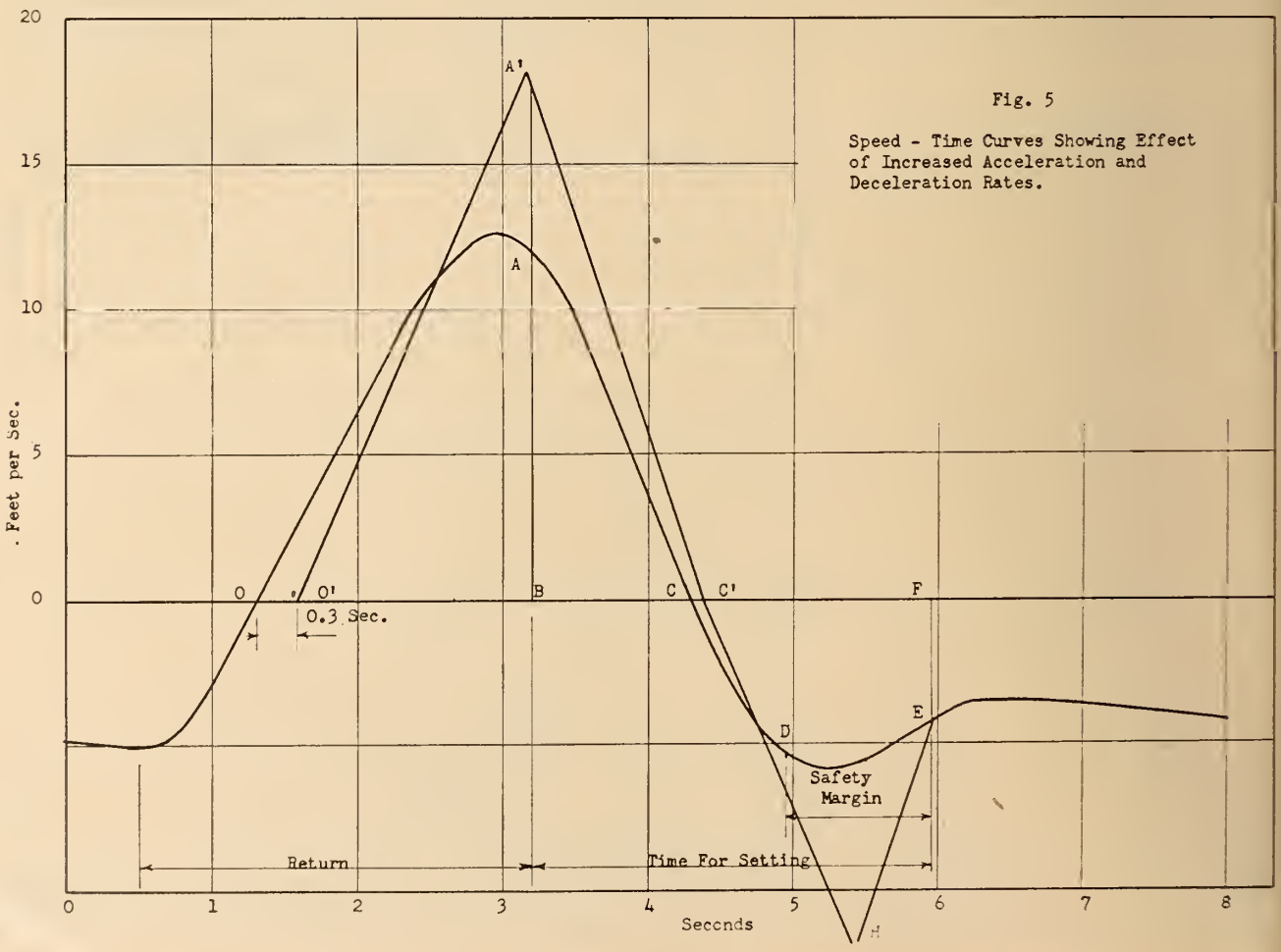
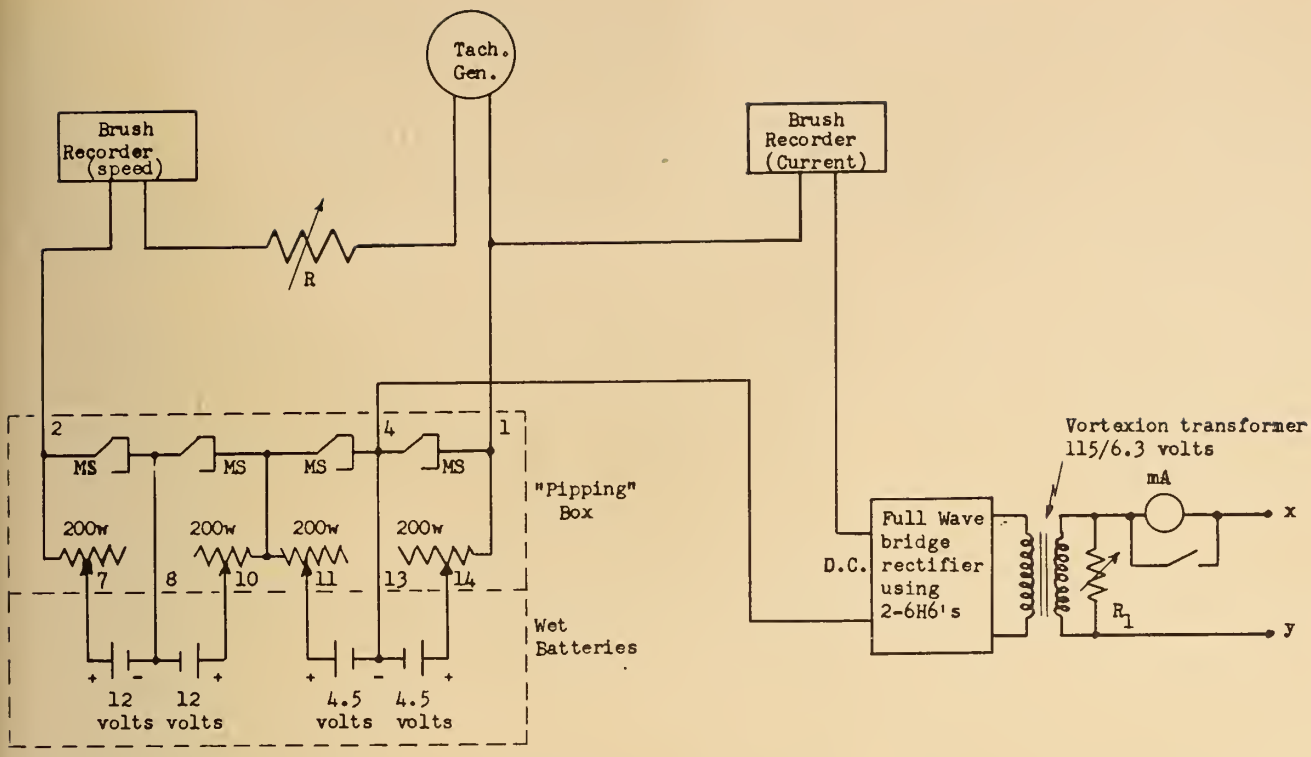


Fig. 5

Speed - Time Curves Showing Effect of Increased Acceleration and Deceleration Rates.



MS -- Micro switches
R -- General radio resistance box - 10,000 ohms
mA -- 0 - 150 mA and 0-750 mA A.C.
1 - 15 -- Jones plug and socket
x - y -- Headsaw motor current trans. circuit
R_1 -- 67w and 20w rheostats

FIGURE 6

Headrig Study

Schematic Diagram

be given a rather uncomfortable time.

The curve O′A′C′HE is the new cycle, and it shows a time saving over the actual cycle of only 0.1 sec. Bearing in mind the difficulties of changing the actual cycle appreciably in the direction of the so-called ideal one, it appears very doubtful if much improvement can be effected in this direction. It should be pointed out that with the acceleration and deceleration rates given, the ideal cycle shown is theoretically the best one possible for effecting time savings. This will be clear if it is realized that, for a given setting time, the overall time for return and setting is a minimum when return time is a minimum.

Return time will be a minimum when the highest speed possible is maintained during the return trip, consistent with the requirement that speed be at or below the allowed maximum when the log enters the saw. Referring to Fig. 4, it will be seen that return time is a minimum when the speed at 'B' is a maximum, and the speed at 'B' is a maximum when maximum acceleration is maintained from B to F.

One of the objects of this investigation was to compare the performance of different types of equipment. It is interesting to note here that an electric drive with controlled acceleration could be expected to approach the "ideal" characteristic, because of the nature of the control. However, for the headrig under study, the advantage to be gained in this direction is so small that the electric drive would be expected to show relatively little advantage over the present gunshot feed.

4. As a still further alternative the effect of increased acceleration and deceleration rates has been considered. The simplest way to do this was on the basis of an "ideal" cycle, and an increase of 25 per cent over the original rates was used. Again, the time for setting is unchanged. Original acceleration rate from the curve equals 9.1 ft./sec./sec.; original deceleration rate equals 12.1 ft./sec./sec. Increasing these values by 25 per cent gives the following: acceleration rate — 11.4 ft./sec./sec.; deceleration rate — 15.1 ft./sec./sec.

Curve O′A′C′HE (Fig. 5) shows the cycle with these increased rates, and it will be seen that there results a saving of 0.3 sec. over the actual cycle, or 0.2 sec. over the ideal cycle of Fig. 4. The time savings are therefore small considering the large increase in power, presumably about 25 per cent, necessary to achieve these results. This analysis of the possibilities with higher acceleration rates doesn't take into account the small extra saving possible due to the quicker deceleration at the end of the sawing stroke, but this will be almost a negligible item.

Possibilities of Time Savings

Under this heading will be discussed the various operations going to make up the complete cycle, and the possibilities of effecting time savings.

Setting:

A study of the percentage values obtained in Table I shows a large percentage of time chargeable against the setting operation, 24.5 per cent in the case of the 18-in. log group, and 23.4 per cent in the case of the 28-in. group. Average time for the setting operation is approximately 3 sec. It is interesting to note that the actual setting operation takes only about ½ of the 3 sec. period. There has, of course, to be a safety margin at both ends, so

that setting will not, under any conditions, overlap with sawing.

If an effort is to be made to reduce the time required for the complete cycle, the setting operation appears to be the best place for improvement. If reference is made to Fig. 3, it will be obvious that if the setting time is reduced appreciably, it will also be necessary to reduce speed earlier on the return stroke.

For example, if the setting time could be reduced from a value of BF to a value equal to BC′ + GF, the optimum cycle with present equipment would take the form O′A′C′GE, with the first part of the curve moved to the right until C′ coincides with G. (To simplify the discussion at this point it is assumed that the slope of the new curve is not reduced in the vicinity of the zero speed axis.)

For this cycle it will be seen then, that the time saving is somewhat less than the time saved in the setting operation itself, and is equal to C′G − O′O (Fig. 3). In the example, the setting time is reduced from 2.75 sec. to 1.25 sec., and the time saved is equal to 2.75 − 1.25 − 0.2 = 1.3 sec. Were it possible to effect such a saving it would represent a 13 per cent time saving on a 10 sec. cycle.

Two Alternatives

There are two fields to explore in attempting to reduce setting time. The first possibility would be to reduce the present safety margin at both ends of the setting operation. It seems quite conceivable that this might be done if some automatic safety device, which might take the form of a limit switch, were introduced to stop the setting operation automatically at the instant the log enters the saw. The same device would have to be used to prevent the initiation of the setting operation, until the log clears the saw on the return stroke.

The second possibility is to increase the speed of operation of the set works. This would probably require the use of a servo-type control, rather than the follow-up device commonly used at present, and could also include presetting. In view of the wide use of servos at the present time, improvements in this direction are bound to come before very long.

Sawing

Possibilities of time saving in the sawing operation do not appear good, at least with the present equipment and saw speeds. It is noticeable, however, that in the present operation the carriage speed normally drops about 20 per cent after the start of the sawing operation. Later, the speed rises, but the result is that the average speed is probably 10 per cent down on the speed at which the log first hits the saw. It seems likely that the initial drop in the speed is unintentional, and results from the type of control involved. If the initial speed were maintained, the time saving of perhaps 10 per cent in the sawing time, or 3 per cent of the total cycle time, might be effected.

Return Travel

While the total time occupied by the return operation is relatively large (23.7 per cent in the case of 18-in. log group) it doesn't appear likely that appreciable savings could be effected in this direction. The analysis of the single cycle given above shows that acceleration and deceleration rates have to be increased markedly to have much effect.

Loading

Time taken for loading is small and no suggestions are offered for improvement. There doesn't appear to be any evidence from the present analysis that the distance from the loading deck to the saw accounts for any time. It would, however, if the setting time were appreciably reduced.

Turning

Turning time for the 18-in. log group was only 8.1 per cent of total time. However, the data showed an average of only 1.2 turns per log, which is low. Both this and the percentage figure are higher for the larger logs. The turning operation appears to be a relatively efficient one in the present case, but comparative data on other log turners will be more informative.

Looking for ways of saving time, it is obvious that practically the whole time required for turning could be saved if the log were turned by a mechanism on the carriage, rather than by a mechanism on the deck. However, possibilities in this direction don't look particularly encouraging, since there is the rather difficult problem of keeping the log clear of the saw during the return stroke.

Unloading

Using the definition of the unloading period given earlier results in a figure which might be questioned. However, a study of this part of the cycle shows that the whole period, from the end of sawing to the rest position, should not be chargeable against unloading while on the other hand a small part of the time required for the return stroke should really be included. In the present instance there is an error of about ¼ sec. each way. Thus the figures obtained give a very close picture of actual conditions. The time required for unloading is again small, and no suggestions can be offered at the moment for improvement.

Obstruction Time

Time lost due to obstructions has to be considered over a relatively long period, and even then could hardly be considered representative. In the present instance the time loss was very small, only 1.6 per cent for the 18-in. log group.

General Discussion

A review of the results indicates that the equipment under study is being used extremely effectively by the operator whose sawing was under study. However, it does show that various possibilities for improvement are worth exploring.

Records were taken during one period with a relief sawyer on the job and there was an observable difference in the shape of the speed-time curves. The relief man tended to slow down earlier on the return trip than the regular sawyer, so was not making as good use of the equipment as he might have been. Times for turning, loading, etc., were also longer as might be expected. Detailed analysis could unfortunately not be made as one recorder started to run slow at this point.

The speed-time curves emphasize the degree of skill required by a good sawyer. It may well be that the means of control for the gunshot should be studied with a view to making it easier to get the most out of the equipment.

It is hoped to continue this investigation by including tests on carriages with steam engine and electric drives. It is believed that the comparative data on drives, as well as on other equipment such as log turners, will give management real assistance in assessing the merits of equipment for individual mills.

The writer gratefully acknowledges the assistance of members of the industry who assisted in the planning stages of this program, also the co-operation of Mr. Louis Biden and the Alaska Pine Co. Ltd. in carrying out the tests, and finally the assistance in all stages of the program from a number of members of the B.C. Research Council staff.

Modern Pioneers

by

Dr. N. R. Crump, M.E.I.C.

Senior Vice-President,
Canadian Pacific Railway Company,
Montreal.

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

Paying tribute to the part engineers have played in Canada's accelerating growth, the author defines the four tools given them to work with, listing a fifth, money, as the instrument they use for directing their skills to the creation of wealth.

Pointing to some of the transportation problems awaiting solution, he shows there still remains unlimited scope for the engineer's creative ability.

I deeply appreciate the honour of being asked to address this illustrious gathering; for it is safe to say that nowhere else in the world has the engineer played so large a part in the development of a nation as in Canada. At the same time, no country offers a wider scope for the exercise of his talents.

We are frequently prone to overlook the unique good fortune we possess in Canada, having, in the Engineering Institute, one central body comprising engineers from all branches of the profession. I say good fortune, as though this were an accidental occurrence. It would be more accurate to describe it as the result of broad vision and sound design. The wisdom of this arrangement will become more and more apparent in the years which lie ahead.

Engineering is still a relatively young profession. It is only about two hundred years since the term "civil engineering" was first employed in England, in contradistinction to military engineering. In the United States the centennial of the founding of the American Society of Civil Engineers is being celebrated this year.

In the intervening period the profession has divided and subdivided into the many branches we know today. This specialization was inevitable, and will doubtless continue as the horizons of knowledge are widened, and as our probings into the secrets of nature are deepened. Nevertheless, each branch of the profession has much in common with the others. As specialization continues, the existence of an organization to facilitate the exchange of ideas, to stimulate personal contacts, and to represent the profession in the nation will become increasingly important. For the Engineering Institute of Canada does much to promote the interests of the profession as a whole — not in a narrow or selfish sense — but rather as a means of enabling engineers to serve our country more effectively.

Canada's Growth Accelerating

If the title of my address seems to employ contradictory terms, it is because much of what is taking place in Canada today illustrates similar contrasts. We think of ourselves as a "modern" nation. Are we not one of the major trading nations of the world? Do we not enjoy a standard of living second only to that of our good friends south of the forty-ninth parallel? And if these things be so, how then can we claim to be pioneers? Yet, strange as it may seem, that is just the situation in Canada today. Before expanding on this aspect of my remarks, permit me to lay a foundation.

The story of the growth of Canada has been told many times. But it is a big story, and one which will bear repeating. No portion of this broad land has been inhabited by the white man for as much as three hundred and fifty years. While this is a considerable length of time to us as individuals, it is only a brief period in the human calendar. It is, in fact, less than the time during which Britain was occupied by the Romans. Our nation is just approaching its eighty-fifth anniversary. In other words, there are Canadians now living who are older than Confederation itself, and who are able to recall July 1st, 1867. Here on the shores of the Pacific we are meeting in our third largest city, situated where there was only a forest seventy-five years ago. So my first point is the youth of Canada.

Secondly, Canada has become a big nation — not in terms of population which, at fourteen million, would rank it in about twenty-eighth place in the countries of the world. Nor is Canada's size measured simply in terms of area. Only 9 per cent of our land is classified as agricultural, 37 per cent is forest area, and the remaining 54 per cent is barren; that is, barren on the surface but of great importance for its hidden mineral wealth. The true relative stature is measured rather by production, which reflects the

extent of our resources, the vigour of our people and the efficiency of the tools with which we work.

Notwithstanding our relatively small population, we are one of the leading exporting nations in the products of agriculture and one of the leading producers of forest products, including pulp and paper. Out of 25 of the world's most common metals and minerals, Canada is a leading supplier of 10, by virtue of the fact that for these 10 she ranks amongst the 4 major producers. As a result of all these things, our national production has grown to the point where it rivals that of France, a much older and more populous nation.

The third point I would like to make is that, although Canada is a young country and a major producer of primary products, it is fast becoming highly industrialized. While this change has been taking place gradually over a period of years, it was greatly accelerated during World War II, and that trend has continued and become even more pronounced since. Evidence of this is to be found in our electric power production, which was 28 billion k.w.h. in 1939, jumped to 40 billion k.w.h. in 1945 and skyrocketed to 57 billion k.w.h. in 1951.

In spite of these accomplishments, there is ample reason to believe we are just on the threshold of even greater developments. As examples, here in British Columbia vast undertakings are in progress for the production of aluminum and for the conversion of forest resources into useful new materials. On the Prairies the discovery of new supplies of oil and natural gas continues apace. And in Eastern Canada lands hitherto regarded as tractless waste are being unfolded to secure that most important mineral, iron ore.

The Four M's of Engineering

It was in the light of these facts that I stated at the outset of my remarks that no country offers a wider scope for the exercise of the talents of the engineer than Canada today. In a narrow sense his role is to conceive and construct the plants and other facilities needed to make these resources of nature available for our use. In so doing, the tools he employs may be described as the four M's of engineering — Men, Machines, Materials and Methods.

Men naturally stand at the head of the list. Without men there can be no engineering. Not only are men's wants the final objective of all engineering, but engineers themselves are men and are dependent upon other men for the details of their designs and for the execution of their works. Consequently, the engineer must be not only a chemical, electrical, mechanical, or civil engineer — he must also be a human engineer. He must understand the men with whom he is associated, both those who are superior and those who are junior to him.

Human engineering is perhaps more an art than a science. It comes with experience, but there are some simple basic principles to keep in mind. First of all, the engineer must be a teacher — an on-the-job instructor. The main thing to remember in teaching is that the student should be led from the known to the unknown through a logical sequence of facts. That applies whether the engineer is unfolding a scheme to the Board of Directors, or teaching an apprentice how to run a lathe or use a slide rule.

It is well for the teacher to remember the remark of the Englishman, who was once asked why he wore a monocle. He replied that he wore a monocle so that he would not see more at one time than he could understand.

The imparting of knowledge, know-how and know-why is a necessary prelude in the art of getting people to act. The fancy name for this is human motivation. It used to be said that men were motivated by one of two things — either love of God or fear of the Devil. That was probably an oversimplification of complex human nature, but it was a dramatic way of saying that men act to gain pleasure and to avoid pain.

Far be it from me to plunge into the psychology of pleasure and pain. But we all know from practical experience that men naturally seek (and respond to) leadership. Now a man can be a good leader without possessing the so-called magnetic personality. He can be a good leader if he has the knowledge and the will power to make decisions, if he is honest in what he does and says, and if he is firm but fair in issuing orders and imposing discipline. The leader's job is to get every shoulder to the wheel, pushing at the right time and in the right direction.

The engineer's technical knowledge and experience frequently puts him in the position where man looks to him for leadership. He should not neglect the art of human engineering. Man is a highly sensitive creature with a wide range of power and efficiency, and notwithstanding the mechanization of modern times, the human factor is still predominant.

M also stands for Machines, Materials and Methods. It is not my purpose to deal with these items in detail here. Each of them denotes a field so broad as to defy enumeration, particularly at a time such as the present, when new products and techniques are being introduced so rapidly. For present purposes, it will suffice to remember that the engineer has a definite responsibility in seeing that machines, materials and methods are employed appropriately to the end to be achieved. These four M's, Men, Machines, Materials and Methods are closely interconnected. New machines beget new methods, and new materials demand new machines and new methods. Together these three add up to greater production and a higher standard of living for men.

The Fifth is Money

But in addition to those tools which I have already mentioned, M also stands for Money. In the engineering profession, money plays a much bigger role than simply denoting the size of one's pay cheque or the amount of one's professional fees — and I do not belittle the importance which even engineers attach to these considerations. But for engineers, particularly those engaged in managerial or industrial fields, money also measures the economic forces which the engineer must take into account. Investment dollars are required to translate his works from the drawing board to reality — to give birth to the project he has conceived. Consumer dollars are necessary to keep it alive.

If they can be attracted in sufficient numbers to meet operating costs, and pay a reasonable return on the investment, the project is a success. Thus, money, whether it be the investor's dollar or the consumer's dollar, is the instrument by which men and women direct the engineer's imagination and skills into the creation of those things which men want most. In a free economy, the engineer remains the servant of mankind — no matter how mighty his works nor how far-reaching his projects.

All projects promoted by free enterprise must compete in the money markets for investment dollars. In this country, the works of free enterprise account in the aggregate for a major portion of the national investment. All of this

investment is voluntary; that is, the investor is free to decide how much he will invest and where he will invest it.

The investor is interested in an engineering proposition from the point of view of whether it will produce a profit or a loss. Now I submit that we as engineers should give some thought to the way in which the profit and loss system operates in our free economy. There may be times when we wish that we could forget about profit and loss and just get on with the engineering job. Some of us may even be tempted at times to seek refuge in the theory that private profit is anti-social and that the free enterprise system should give way to a system of state capitalism in which the government would own and control all the means of production and distribution of goods and services.

Advantages of a Free Economy

Let us consider the matter first from the standpoint of the engineer. In Canada today we have engineers employed by the government and by private enterprise. Happily, in our free country, the engineer, whether he be employed by the government or by private enterprise, is at liberty at any time to quit his job and seek employment elsewhere.

If, however, all undertakings were owned and operated by the government, there would be but one employer; there would be but one source of capital to carry out the engineer's ideas, and that would be capital provided by the government at the expense of the taxpayer. There can be no doubt that free enterprise offers more freedom, wider scope and keener inducements to the activity and genius of engineers than can be provided under state capitalism.

Let us look at the question from the viewpoint of society as a whole, which, we all agree, is the most critical test. The great merit of the free enterprise profit and loss system is that it is self-activating and self-regulating. The search for profit and the desire to avoid loss, cause capital, labor and material to be used in combinations where they will produce the greatest values in goods and services. Thus the profit and loss system in the long run tends to keep prices down because it directs our productive resources into those channels where they will produce in the most efficient manner the goods and services which are most desired.

In the free economy, the consumer is boss. That is surely a good thing; for the ultimate measure of any economy, of any system of producing and distributing goods, must be in terms of what it does for the consumer. In the free economy, competition for the consumer dollar is a powerful incentive to improve products and lower costs. Engineers, aided by investment of capital, play an important part in the improvement of products and lowering of costs. The entrepreneur and the engineer together are largely responsible for the ever higher standard of living enjoyed by each successive generation of Canadians.

For the benefit of younger engineers in this audience, I should say that times have not always been as good as they are now. Demands for the services of engineers have not always been as keen as they are now. In the past we have experienced fluctuations in business conditions. They may occur again. The point I am trying to make is that over the long pull — taking the lean years with the fat years, the free economy has served our country well and provided engineers with wonderful opportunities for creative work.

Problems in Transportation

To turn again to my opening remarks, I stated that nowhere in the world had the engineer played so large a part in the development of a nation as in Canada. This arose from the fact that the long distances which separate communities in Canada from one another, and from world markets, have made this country particularly dependent on transportation. I need not stress, before this audience, the importance of transportation in the national economy. In fact the railways have made a united Canada possible. One of the terms under which British Columbia entered Confederation was that a railway be built to the Pacific Coast joining that province by rail to the rest of Canada.

Although we possess a comprehensive and growing network of rail lines, highways, pipe lines, waterways and airways — transportation pioneering is not all behind us by any means. The glamorous days of spanning a continent and laying rails through the Rocky Mountains may be gone, but the search for quicker, safer, more comfortable and more economical means of transportation continues. Here indeed is a field for the skill, imagination and ingenuity of our engineers, and for application of the five M's of engineering of which I spoke a moment ago. As I visualize the future, major developments may be anticipated in all of the four principal aspects of transportation — power, vehicle, way and communications.

In the power field one of the most important considerations is economy. This applies equally to railways, which are endeavouring to lower costs, as well as to airlines striving to increase payload and extend range. Here we may expect still further developments of internal combustion engines of various types seeking to reduce weight and size, increase output, lower fuel consumption and utilize less expensive fuels.

The diesel-electric locomotive is taking the place of steam engines. Jet propulsion is challenging the reciprocating engine in aviation for civil as well as military use. The gas turbine is contending for recognition as a prime-mover, and engineers are endeavouring to develop a coal-burning gas turbine locomotive. It is quite within the realms of possibility that within our time atomic engines may prove practicable and economical for commercial transportation.

Vehicles will also be subject to change. Much progress has already been made in this direction by the aircraft industry, in which weight and wind resistance are such important considerations. Hence the shape of aircraft and materials employed in their construction have undergone radical changes. This process will undoubtedly continue, not only with respect to aircraft, but in other fields of transportation as well, according to the degree in which these factors affect their operations.

In respect of way, there is a contrast between highways and railways on one hand as compared with water and air transportation on the other. The former move along defined routes over ways specially constructed for their use. The latter move through natural media, water or air as the case may be. But whatever the mode of transportation, and the medium it employs from point to point, terminal facilities have to be provided.

The problems of collecting, dispersing and passing traffic through our cities are becoming more and more pressing, as evidenced by the congestion of streets with which most of us are familiar. Terminal handling problems are not confined to street and highway vehicles.

(*Continued on page 1322*)

Another Step Towards Canadian Self-Sufficiency

by

E. F. Tabisz

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A paper presented to the Toronto Branch of The Engineering Institute of Canada, February, 1952.

In step with Canada's expanding industrial development, Underwriters' Laboratories of Canada now has a Canadian Head Office and testing station in Toronto. Annual listings of inspected appliances, equipment and materials are published. The author appeals to engineers to specify laboratory-tested equipment and materials, thus assisting in the prevention of fires.

All of us are ever-conscious these days of the fact that Canada is undergoing a stage of rapidly expanding industrial development. There is evidence of it all around us. Newspapers, trade publications, and other periodicals regularly contain many references to new discoveries of raw materials, new production techniques, plant construction projects, expansion of existing manufacturing facilities, and numerous other developments.

A few months ago we saw full-page advertisements heralding the arrival at an eastern refinery of the first tanker of Alberta oil delivered to the lake head by pipe line. More recently we learned that, owing to additional facilities under construction, Canadian industry will shortly be able to synthesize all of the raw materials needed for the nylon produced in this country.

There is a much wider use of mechanical and electrical appliances and equipment than ever before. Improved methods of processing commonly known products such as wood, paper, and textiles are being developed. All of these wonderful developments are making Canada more and more self-sufficient. In contrast to such great progress toward self-sufficiency now in motion, the story I am about to tell you today may not prove to be world-shattering. Yet in its particular field, it carries considerable significance. Unfortunately, these great advances in science and industry are also ushering in with them a continually increasing risk of fire and accident. Factual information to help stop fires before they start, and to prevent accidents, is urgently needed.

Origin of Underwriters' Laboratories

For some 57 years the capital stock fire insurance companies of Canada, England, and the United States have been operating a testing laboratory on the North American continent. Its purpose is to provide authoritative information, based on tests, to insurance organizations, to various inspection departments, and to the general public with respect to the life and fire hazards of devices and materials in daily use. As you all no doubt know, the name of that testing organization is Underwriters' Laboratories, Inc.

When it was originally formed in 1894, Chicago was chosen as its headquarters. However, many of the insurance companies which operate in the United States also operate in Canada, either directly or through affiliates. Also, it should be remembered that fire prevention and fire protection are universal problems. Therefore the information developed by the Laboratories in Chicago was, from the very beginning, of great benefit to fire protection authorities of both countries, and at present is enjoying almost world-wide recognition.

Under date of August 18, 1920, Underwriters' Laboratories of Canada was formed under a Dominion Charter. Because of relative production volume and other circumstances, the actual establishment of a testing station in Canada had to await a more opportune time. As a result, for many years Canadian-made equipment submitted to Underwriters' Laboratories continued to be processed at the principal testing station in Chicago, or at the branch laboratories in New York and San Francisco.

Testing Station Established in Canada

The recent great expansion in Canadian industry dictated the need of establishing a testing station in Canada. Recognizing this need, the capital stock fire insurance companies operating in this country took concerted action and, in my humble opinion, made a very important contribution toward Canadian self-sufficiency.

The great forward step was formally taken on December 2, 1949, when the Board of Trustees

of Underwriters' Laboratories, Inc., authorized the transfer of the charter and assets of Underwriters' Laboratories of Canada to the Canadian capital stock insurance companies, as represented by the membership in the Dominion Board of Insurance Underwriters.

Consequently, we now have a testing station in Canada that in due course will be equipped to handle much of the test work which heretofore required shipment of samples to the United States. For several important reasons, we also have an organization operating as a separate entity, rather than being directly affiliated with the Laboratories in Chicago. This was deemed essential in order to give Underwriters' Laboratories of Canada a freer hand in the development of standards for the testing of products intended primarily for Canadian consumption. Our present policy is to follow the same basic standards which have been used so successfully by the Laboratories in Chicago. It is anticipated, however, that some deviations will be necessary to keep them in line with Canadian codes and practices.

The Canadian Head Office and Testing Station is located at 340 Richmond St. West in Toronto, Ontario. The task of organizing a technical staff, and of setting up testing facilities, was begun on January 1, 1950. We did not actually begin from a standing start, because with the transfer of the charter we assumed responsibility of carrying forward the factory inspection and labeling of many Canadian-made products that prior thereto were covered by the listings of the Chicago organization. Thus, there has been no interruption in the testing for safety service sponsored by capital stock insurance, that has been available in Canada and the United States for 57 years.

The growing pains of Underwriters' Laboratories of Canada during the past two years would have been very light indeed, if it were possible to contract for the services of 30 or 40 engineers and technicians thoroughly familiar with all phases of our type of work. Also, we might be able to keep step with the demand for our services if it were readily possible to purchase in the open market the highly specialized test equipment that is needed.

Obviously, such a large group of properly qualified experts could not be assembled. They must first be trained. Further, much of the required test equipment must be built to unusual specifications. In that phase of our operations, we began almost from a standing start.

A Non-Profit Enterprise

We must admit that our self-sufficiency will not grow at a jet-propelled rate. For some time to come we will find it necessary to rely on our cousins in Chicago to run tests for us, on products requiring facilities or know-how that we may lack. Our current staff consists of 28 members at the Toronto laboratory, and part or full-time factory inspectors in 21 cities across Canada.

An important point to remember is that, although we are operating independently of the Laboratories in Chicago, the nature of the sponsorship of the two organizations is identical. A close technical liaison between the two organizations can therefore be maintained. We are continually able to share in the experience accumulated over a period of more than half a century in dealing with problems relating to life, fire, or accident hazard. A very effective engineer training program has been worked out. As is the case with our counterparts in Chicago, our operations in Canada also include an inspection and certification service on burglary protection equipment and installations.

Underwriters' Laboratories of Canada is a non-profit organization. At present our financial support comes partly from industry through fees for engineering services and charges for factory inspection work, and partly from capital contributed by members of the Dominion Board of Insurance Underwriters. In due course, when our efficiency reaches a reasonably high scale, we hope to become more or less self-supporting. That is, the fees paid by submittors and listees will help to write off all or most of the operating expense. So you see our organization is entirely a creature of private enterprise.

Submittals are Voluntary

As a testing organization, Underwriters' Laboratories of Canada has no control over the sale or installation of equipment. We have no direct control over insurance rates. Generally speaking, the label of Underwriters' Laboratories of Canada has no fixed legal status. It is gradually finding its way about to all parts of Canada seeking its own true level. We have no desire to hold a monopoly on approval work.

Underwriters' Laboratories of Canada does not solicit business, because solicitation carries an implied promise of delivery. We are unable to forecast results of the investigation, and so we cannot assure the prospective submittor that a favorable report will be forthcoming. Also, we are unable to predict what benefits, if any, will be derived by the submittor if and when his product does earn the label. We are always happy to discuss and explain our services, but we invariably leave it entirely to the prospective submittor to make his own decision. In short, the submittals are entirely voluntary.

Closely related to this entire problem of voluntary submittals, legal status of approval labels, etc., is the fact that we should all consistently strive to keep fire as our servant and not let it become our master. To help preserve the natural and created wealth of Canada is the responsibility of all Canadians. Much can be accomplished in that direction by you engineers in your respective fields, by specifying laboratory tested equipment installed according to practices recommended by recognized authorities.

Our first list of Inspected Appliances, Equipment, and Materials was published under date of September 1950. A semi-annual supplement was published in March 1951. Since then, our September 1951 Annual List superseding the precious two booklets has been distributed.

As each investigation is completed, a report covering our findings is furnished to the submittor. Any number of additional copies can be obtained by the submittor for distribution. We normally do not send them out directly to the general public, except by special authorization from the submittor. We also publish 3 in. by 5 in. listing cards, on which the classification of each device is summarized. These cards are on file in many inspection departments across Canada.

Recent Developments

I will not attempt to tell you very much about the types of products that we test, or about the methods we employ. Nevertheless, you may be interested in a few of the more recent developments that have been investigated by Underwriters' Laboratories. Some of the modern doors now available for use in openings in walls and partitions as a protection against fire no longer look like the conventional fire doors with which most of us are familiar. They are similar in appearance to an ordinary flush type wood door, but may carry a Class B, C, D, or E fire door label.

At present these newly developed doors are made in three types. The first is a composite door, consisting of an incombustible core encased in chemically treated wood banding, with untreated wood veneer on each face. The second type consists of a chemically impregnated wood core and cross banding, with an untreated wood veneer bonded to each face. The third type consists of an incombustible core encased in a metal covering, which can be finished so as to produce a wood grain effect.

Currently, these doors are made under the Label Service of Underwriters' Laboratories only in the United States. There is evidence, however, that production of them may shortly be initiated in Canada.

The testing of concrete walls for fire resistance is not new, but today some concretes available to the building industry are so light they will float. These and many other developments keep the Laboratories' furnaces continually busy. Much is being done in the development of lightweight plasters and concretes for fire protection of steel, that can be applied to structural steel members by spraying.

Interest in the development of test methods, and of fire hazard classification of building materials and interior finishes, is becoming more and more widespread. The method developed by Underwriters' Laboratories for classifying such materials has been accepted as a tentative standard by the American Society for Testing Materials.

The good old brick chimney is fast losing ground these days, particularly in low cost housing projects. Prefabricated flue assemblies, lighter in weight, more efficient, less expensive, and easier to erect have come in on the scene. To provide authoritative information on the safety and practicability of the several different flue designs introduced on the market, Underwriters' Laboratories has evolved a test routine which has thus far proved very reliable. There are three basic flue designs in use at the present time which have passed our tests. One of them is manufactured in Canada.

We also conduct tests on low temperature flue piping and assemblies, intended primarily for use with gas fired appliances where flue temperatures in excess of 550° F. are not anticipated.

The ever-increasing demands for explosion-proof electrical equipment, suitable for use in atmospheres of explosive vapors and dusts, necessitates many new developments in that field. This constitutes a very active phase of the operations at our Toronto headquarters.

A great many of the oil burners and oil-fired space heaters now produced in Canada carry our label. Boilers and other facilities for the investigation of such equipment have been provided at our Laboratory in Toronto.

We at Toronto are equipped to run quite a variety of tests. It is perhaps immaterial as to whether or not I outline to you in reasonable detail the exact nature of the test work we can handle in Canada, because the picture is changing almost daily.

In the meantime, appropriate arrangements with customs brokers enable us to ship samples to Chicago for test with a minimum of inconvenience to the submittor. There is a general feeling among maunfacturers that the cost of running tests could be reduced appreciably if we handled the entire investigation on each class of equipment in Toronto. Such is not always the case. We agree that there will be some shipping charges on the sample for the round trip to Chicago. In most cases, these shipping charges are negligible. However, that is where the extra expense normally stops.

The organization in Chicago is divided into several departments, each with a highly trained staff geared to handle specific classes of equipment with a minimum of effort. Operating in that manner, they are in many instances, able to complete the test work in less time than we could. Therefore, the speed with which we succeed in providing some of the more elaborate test facilities in Canada to deal with any contingency should be of little consequence to the submittor from the time and cost standpoint.

It is hoped this general outline of our current operations has been of some interest. In our type of endeavour we are continually carrying on projects of a research or semi-research nature. Therefore, it is also hoped that, if we are again afforded the opportunity to speak before this distinguished group, we shall by that time be prepared to present a technical paper of general interest.

MODERN PIONEERS

(*Continued from page 1319*)

Railway and airlines are facing problems of a similar nature, particularly in the larger centres. The solution of these problems requires careful study and well planned measures.

Communications are essential to transportation; first, to promote safety by appraising the vehicle operator of conditions which lie ahead, and secondly, in the interests of efficiency, to expedite the handling, transfer and delivery of the cargo or passengers. With increasing speed and frequency of transportation services, the necessity for adequate communication facilities becomes even more important.

Fortunately, remarkable technological advances have been made in recent years. The development of radar, microwave and various methods of aircraft flight control have occurred in a remarkably short period of time. It is safe to say that each of these and other new techniques will be employed to an increasing extent by transportation agencies to enhance safety and increase efficiency.

Nowhere a Brighter Future

Doubtless there is future pioneering to be done in other industry paralleling that in the transportation field. But, in closing, let me say this. Whatever our problems of the day may be, and we have problems, — we have had them in every decade; Canada's long-term future prospects are surely among the brightest on this earth. In the eyes of the world we are sturdy and free. The world has confidence in us. Let us have confidence in ourselves and be worthy of the great trust that has fallen into our hands. We have an economy that is basically sound. We have a system of government that is basically sound.

Our achievements of the past and our opportunities of the future were dramatized by Winston Churchill when he closed his speech in Ottawa last winter in these words—"When I came here after the Boer War these mighty lands had but 5,000,000 inhabitants. Now there are 14,000,000. When my grandchildren come here, there may well be 30,000,000. Upon the whole surface of the globe there is no more spacious and splendid domain open to the activity and genius of free men."

Those were stirring and challenging words. In accepting that challenge, Canada looks to its engineers for much of the activity and genius of free men. It is our duty to see that she is not disappointed.

FROM MONTH TO MONTH

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

Proposals to Change the By-laws

In this issue of the *Journal* members will find several proposals to change the by-laws. These are recommended by the Council of the Institute and received the unanimous approval of Council at its meeting on October the 10th, 1952.

All these changes will be brought before the Annual Meeting of the Institute in Halifax on May 20, 21 and 22, 1953. On that occasion they may be approved, revised or struck out. If approved they then go forward to the membership within a period of two months for final approval. It requires a favourable vote of at least two-thirds of the ballots cast to approve any of the proposed changes.

When the ballot is submitted to the membership there will be a complete explanation of the reasons back of all the proposals, but it is felt that the membership will be interested now in knowing why the changes are proposed.

By-law Section 3 provides that Juniors shall be classified as Corporate Members although still retaining the classification title of "Junior Members", and the Junior fee. This has been requested by the Branch Officers' Conference on two separate occasions and by several branch executives. It is felt that the time has come to properly enfranchise these young men. After all, a man can vote in most elections and on most issues when he is twenty-one years of age and hold office. It seems only proper that he should have at least the same privileges in his professional society.

By-law Section 5 — also is based on requests that have come from the branches. The recommendation is that each branch executive be given the power to declare all or any of its members "resident", providing authority has been given to it by a ballot from the membership.

By-law Section 7 — as presently worded precludes the admission of science graduates who are practising engineering. It is proposed that the wording be changed so that a graduate of a recognized science course who has had the necessary experience in engineering can be considered as a candidate for membership without an examination.

With the great changes that have taken place in the field of engineering, it has become increasingly important to recognize the work of certain scientists as engineering. For instance in the field of electronics and in neucleonics the bulk of the work is done by science graduates, but many of them carry on their work far beyond the pure science field and well into the field of engineering. It is felt that such people would be valuable acquisitions to the Institute and that the Institute should recognize the changes in the profession of engineering by admitting them when they have the requisite engineering experience.

Some of the associations with which the Institute has co-operative agreements already admit such persons to full membership and under the terms of the agreement, the Institute also must admit them. Thus it is that the Council of the Institute is in the unreasonable position of having to prescribe an examination for a man in one province, whereas in another province he can be admitted without an examination.

By-law Sections 21-22 and 28 — These sections relate to fees and subscription to *The Engineering Journal*. Put briefly the proposal is that the fee of Members and Affiliates be increased by an amount of $3.00 a year, but that there be no change for Juniors or Students.

The change proposes also that the subscription to *The Engineering Journal* for Members, Juniors and Affiliates shall be raised from $2.00

Cover Picture

The explosion of Britain's first atomic weapon at Monte Bello on October 3rd last is portrayed in our cover picture this month. Soon after this picture was taken, the cloud formation was two miles high and a mile across. Within 30 minutes the cloud was fifty miles long.

Photo by courtesy The United Kingdom Information Office, Ottawa, Canada.

to $4.00 per year and for Students from $1.00 to $2.00 per year.

It should not be difficult for any member to understand that the cost of operating the Institute has increased substantially in recent years. As a matter of fact the fees of the Institute have been changed only twice in the last twenty-five years. The first of these changes was to reduce the entrance fees from $25.00 to $10.00 for Corporate Members and by a corresponding amount for Juniors. The second change was to increase the fees of Members and Juniors. This was authorized in1946.

Almost all organizations have found it necessary to increase their fees in the last few years. In fact it is believed that the Institute is about the last one to make the change. When it is considered that at the end of last year the surplus amounted to only $351.20, it becomes readily apparent that additional revenue is necessary.

With the increased revenue it is proposed to expand the services of the organization. It is hoped to make substantial improvements in *The Engineering Journal*, to improve the field services, to increase activities with the students and the young engineers, to increase the number of technical papers and meetings, and to give more assistance to committees.

By-law Sections 34 and 46 — The changes here are proposed in order to bring about a more efficient method for the signing and countersigning of cheques. The present system is unsatisfactory to the Finance Committee and these changes are proposed in accordance with the committee's recommendation. They will not affect the membership in any way and are strictly an internal matter.

By-law Sections 42-43 and 44 — The change here relates to a simplification of the present method of voting for and electing officers of the Institute.

For many years the branches in making nominations for their councillor and for vice-president in their zone have submitted one name only. The present by-laws require that this one name be sent out to the entire membership to be voted upon. This procedure has been wasteful both of time and money. It is necessary to set up a scrutineers' committee which must spend at least half a day in opening the ballot, just to discover that the one name submitted has been voted for. The cost of printing and mailing these runs between $400.00 and $500.00 per year.

The proposal does not take away from the members the privilege of nominating persons other than those who are the official nominees of the branch executives, but it does place a limit on the period of time in which the additional nominations can be made. At present they can be made right up to the time the ballot is returned. The proposal sets December the first as the end limit and states that if no further nominations are received by that time Council shall declare the one nominee to be elected by acclamation.

Some members have complained that a ballot with only one name on it was not a ballot at all and even suggested that this was not a democratic way to run an election. However, the fact remains that the branch executive and individual members are permitted to make as many nominations as they wish. If only one name is sent in by the branch executive then it becomes apparent that he is the man the executive wish to have elected. In such circumstances it would be wasteful and unsatisfactory to insist on further nominations.

By-law Section 52 — among other things sets the date for the annual meeting of the Institute. At the present time the date is "the fourth Tuesday in January or any other date in January as the Council may direct".

The proposal is that the specific date be eliminated and that the selection of a date, no matter in what month it may occur, be left entirely to the discretion of Council.

By-law Section 55 — relates to the number of times Council shall meet. As presently worded it requires Council to meet every month from October to May, but not outside of those months. There are times when the amount of business for a Council meeting every month within that period, is too small to justify a meeting. Therefore it is proposed to make it optional with Council as to the number of meetings held, but that there shall be at least one meeting every two months within the prescribed period.

All these changes have been under consideration for a long time. Practically all of them have been discussed with the branch executives of every branch across the country, and they have received almost unanimous approval. They have been approved at three different Council meetings in different parts of Canada. Under these circumstances it is hoped by Council that the membership will give approval to them when they go out to ballot. If in the meantime any members have any comments they wish to make on the proposals, either for or against, they will be welcomed by Council.

The Proposed Amendments

In accordance with By-Law No. 80 notice is hereby given that certain proposals to amend the by-laws will be presented to the membership at the Sixty-Seventh Annual Meeting which takes place at Halifax on May 20, 21 and 22, 1953.

The by-laws provide that discussion will be invited at the annual business meeting and that approval of that meeting must be given before the proposals may go forward to the membership by ballot for final approval.

By-law Section No. 3. It is proposed to amend this in such a way that Junior members shall be classified as Corporate Members. The second sentence is to be altered so that it reads "Members, Juniors, and Honorary Members who have previously been Corporate Members shall be styled 'Corporate Members' ". The next sentence shall be revised to read "Students, Affiliates, and Honorary Members who have not previously been Corporate Members shall be styled 'Non-Corporate Members' ". The last sentence is to be struck out.

By-law Section No. 5. It is proposed that a new paragraph be added as follows — "Notwithstanding the previous paragraph any branch may declare any or all of its members to be branch residents, providing the branch executive has solicited the members previously by ballot and that two-thirds of the ballot are favourable".

By-law Section No. 7. The purpose of the recommended revision here is to permit science graduates whose academic training is acceptable to Council to be admitted as Members of the Institute providing they have had the requisite amount of experience in the field of engineering.

The proposals are (a) that the words "in a school of engineering" be struck out so that the first sentence will read "A member shall have been engaged in some branch of engineering for at least six years which period may include appren-

ticeship or pupilage in a qualified engineer's office or a term of instruction recognized by the Council".

In the second paragraph strike out the words "course of engineering" and substitute therefor "course of instruction", and strike out the words "an examination as prescribed by Council" and substitute therefor "a schedule of examinations as prescribed in each case by Council", so that the sentence will read "Every candidate who is not graduated from a course of instruction recognized by the Council shall be required to pass an examination as prescribed in each case by Council on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged."

By-law Sections 21-22-28. The proposed changes provide for an increase in fees for Members and Affiliates and in the price of the *Journal* for Members, Juniors, Students and Affiliates.

Section 21. It is proposed that the fee for Corporate Members and Affiliates be increased by the amount of $3.00 per year. There is no change proposed for the annual fee for Juniors or Students.

By-law Section 22. It is proposed that for Members, Juniors and Affiliates the annual subscription to the *Journal* shall be changed from $2.00 to $4.00 per year and for Students from $1.00 to $2.00 per year.

By-law Section 28. It is proposed to change the rates for compounding fees to agree with the increased fees and *Journal* subscription.

By-law Section 34. (The General Secretary) This proposal has to do with changes in methods of signing and counter-signing cheques. In the fifth paragraph it is proposed that the fourth word "certify" be changed to "satisfy himself as to . . . ". In the second line strike out all words after "paid". The sentence will then read "He shall satisfy himself as to the accuracy of all bills or vouchers on which money is to be paid" etc.

In the sixth paragraph after the word "treasurer" add the words "or the assistant general secretary" and after the word "committee", at the end of the fourth line add "or any person so authorized under Section 46", so that the sentence would read "He, or in the case of his absence or inability to act, the treasurer or the assistant general secretary together with any member of the Finance Committee or any other person so authorized under Section 46 shall have authority on behalf of the Institute to draw, accept, sign, etc."

By-law Section 46. (The Finance Committee) The proposal is to revise this section in conformity with the proposed changes in Section 34. It is proposed to strike out in the fourth line the words "It shall approve all bills before payment", so that the sentence will read "It shall employ an expert accountant to audit the books and to certify the annual statements, and shall make recommendations to the Council as to the investment of moneys, and as to other financial matters".

It is proposed that the last paragraph be struck out and in its place the following be substituted "On the recommendation of the Finance Committee Council shall appoint annually one or more members of the Headquarters staff who along with the members of the committee will be authorized to counter-sign cheques as drawn by the general secretary or the treasurer".

By-law Sections 42-43 and 44. The proposals here relate to a simplification of the method of nominating and voting for officers of the Institute.

It is proposed that a new section be added to follow Section 42 and to be known as 42-A, which would read as follows — "In the event of only one name being submitted for any office prior to December the first, Council shall declare that nominee elected by acclamation".

By-law Section 52. This has to do with the dates of the annual meeting. It is proposed that in the first paragraph the first two lines and the first five words of the third line be eliminated, and in their place the following be inserted — "The dates for the annual general meeting of the Institute shall be determined by Council".

By-law Section 55. This relates to the number of times Council shall meet. The first sentence now reads, "The Council shall meet at least once each month, from the beginning of October to the end of April, and at such other times as may be deemed necessary."

The proposed new wording is, "Council shall meet at least once every two months from October to May. Additional meetings that may be deemed necessary to conduct properly the business of the Institute shall be held at the call of the president."

Correspondence

Employment in Canada

On August 20th officers of the Institute gave me the opportunity of having a discussion as to employment prospects for a British emigrant to Canada, and subsequently made available to me the employment services operated by your Institute. I cannot over-emphasize the value of the advice and assistance that your Institute has so generously given to me. I am particularly grateful for the help extended to me by your Miss Summers. On my arrival in Toronto your Toronto office were also extremely helpful.

The enquiries that I have made with Canadian manufacturers have resulted in my receiving several attractive offers of employment, and I am sure that the introduction offered by the Institute largely made this possible. I am very pleased to be able to inform you that I have now accepted an offer from a well-known Canadian company to work as an engineer in their Toronto plant.

In all my contacts with Canadian firms I have been most impressed by the courtesy and consideration which they give to an applicant for employment. Before coming to Canada I had little appreciation of the almost unbelievable rate at which Canadian industry is progressing and expanding.

It is clear that the Engineering Institute of Canada is playing a valuable part in the development of Canada as one of the major industrial nations in the world, and I look forward to having the honour of being associated with the Institute in their future work.

C. N. Downing.

Sixty-seventh Annual General Meeting

Notice is hereby given, in accordance with the by-laws, that the Annual General Meeting of The Engineering Institute of Canada for 1953 will be convened at Headquarters at eight o'clock P.M. on Thursday, January 22nd, 1953, for the transaction of necessary formal business, including the appointment of scrutineers for the officers' ballot. It will then be adjourned to reconvene in Halifax, Nova Scotia, on Wednesday, May 20th, 1953.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Ceramic and Non-metallic Minerals	Chemical Engineering†	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
Memorial University	1st	4				4	21	8					9		3		49
	2nd	11				4	8	8					3				34
	3rd	1				2	3						1				7
Total		16				10	32	16					13		3		90
Dalhousie University	1st	56 (1)															56 (1)
	2nd	36 (2)															36 (2)
	3rd	36 (1)															36 (1)
Total		128 (4)															128 (4)
Saint Mary's University	1st	31															31
	2nd	26															26
	3rd	17															17
Total		74															74
St. Francis Xavier	1st	67															67
	2nd	51															51
	3rd	35 (1)															35 (1)
Total		153 (1)															153 (1)
N.S. Tech. College	4th					9	47 (7)	19 (4)					39 (5)		3		117 (16)
	5th					10 (3)	58 (23)	31 (11)					27 (15)	3 (1)	4 (3)		133 (56)
Total						19 (3)	105 (30)	50 (15)					66 (20)	3 (1)	7 (3)		250 (72)
Acadia University	1st	52															52
	2nd	19															19
	3rd	17															17
Total		88															88
Mount Allison University	1st	62															62
	2nd	44 (1)															44 (1)
	3rd	28 (3)															28 (3)
Total		134 (4)															134 (4)
University of New Brunswick	1st					2	23	18					14				47
	2nd					1	25	12					19		3		60
	3rd					2	21 (1)	20					10		1		64 (1)
	4th						22 (4)	9					9 (1)				40 (5)
	5th						18 (2)	13 (2)					4 (2)				35 (6)
Total						5	109 (7)	72 (2)					56 (3)		4		246 (12)
Laval University	1st	123															123
	2nd	126															126
	3rd					6	34	13				5	5	2	3		68
	4th					7	27	14				4		3	3		58
	5th					9	20 (1)	9				1		3	2		44 (1)
Total		249				22	81 (1)	36				10	5	8	8		419 (1)
Ecole Polytechnique	1st	162															162
	2nd	143															143
	3rd	106															106
	4th						35			26 (1)		6		4			71 (1)
	5th						36			35 (3)		7		2			80 (3)
Total		411					71			61 (4)		13		6			562 (4)
McGill	1st	323 (1)															323 (1)
	2nd	280 (2)															280 (2)
	3rd					32	59	30					61	5	7	17	211
	4th					20	44 (3)	53 (2)					64 (7)	8 (1)	8	9	206 (13)
	5th					21 (1)	62 (4)	30 (3)					48 (6)	3	6	6 (2)	176 (16)
Total		603 (3)				73 (1)	165 (7)	113 (5)					173 (13)	16 (1)	21	32 (2)	1196 (32)
Ottawa University	1st	2				4	9	3					1		1		20
	2nd	1				2	3	2				1			1		10
Total		3				6	12	5				1	1		2		30
Carleton College	1st	33 (1)															33 (1)
	2nd	17															17
Total		50 (1)															50 (1)
Queen's University	1st	248 (1)															248 (1)
	2nd	188 (2)															188 (2)
	3rd					22 (2)	35 (1)	22 (1)				4	37	4	11	10	145 (4)
	4th					18 (1)	38 (5)	27 (8)				4 (1)	31 (9)	6	7 (2)	5	136 (26)
Total		436 (3)				40 (3)	73 (6)	49 (9)				8 (1)	68 (9)	10	18 (2)	15	717 (33)
Toronto	1st		24			113	103	89 (2)	77			30 (1)	98	17	16	55	622 (3)
	2nd		12			63	74	55 (2)	44			9	63 (1)	9	7	39 (1)	375 (4)
	3rd		8			53 (1)	48 (1)	50 (1)	41			5	64 (8)	6	4	14 (1)	293 (12)
	4th		6 (1)			65 (2)	63 (9)	65 (7)	29 (4)			5	60 (7)	3	10 (1)	17	323 (31)
Total			50 (1)			294 (3)	288 (10)	259 (12)	191 (4)			49 (1)	285 (16)	35	37 (1)	125 (2)	1613 (50)

NOTE—The figures shown in brackets indicate, in each case, the number of veterans included in the figure immediately preceding.

REGISTRATION IN ENGINEERING AT CANADIAN UNIVERSITIES — Continued

University	Year	General Course	Aeronautical Engineering	Agricultural Engineering	Ceramic and Non-metallic Minerals	Chemical Engineering†	Civil Engineering	Electrical Engineering	Engineering and Business Administration	Electro-Mechanics	Forest Engineering	Geology and Mineralogy Engineering	Mechanical Engineering	Metallurgical Engineering	Mining Engineering	Engineering Physics	Total
Manitoba	1st	177 (3)	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	177 (3)
	2nd	104 (6)	.....	....	....	.....	.....	.....	.....	...	.....	2	.....	.....	.....	3	109 (6)
	3rd	.....	.....	....	....	.....	30 (5)	25 (4)	.....	...	.....	2	32 (2)	.....	.....	3	92 (11)
	4th	.....	.....	....	....	.....	48 (7)	16 (5)	.....	...	.....	5	30 (6)	.....	.....	.....	99 (18)
Total	.....	281 (9)	.....	....	....	.....	78 (12)	41 (9)	.....	...	.....	9	62 (8)	.....	.....	6	477 (38)
Saskatchewan	1st	222	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	222
	2nd	103	.....	....	....	13	.....	.....	.....	...	.....	.....	.....	.....	.....	3	119
	3rd	.....	.....	....	....	11	21	4	.....	...	.....	7	22	.....	.....	2	67
	4th	.....	.....	1	1 (1)	6	34 (1)	9	.....	...	.....	2	26 (2)	.....	.....	9	88 (4)
Total	.....	325	.....	1	1 (1)	30	55 (1)	13	.....	...	.....	9	48 (2)	.....	.....	14	496 (4)
Alberta	1st	226 (2)	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	226 (2)
	2nd	.....	.....	....	....	28 (1)	41 (1)	19	.....	...	.....	.....	3	.....	9 (1)	.....	100 (3)
	3rd	.....	.....	....	....	33	42 (5)	17 (2)	.....	...	.....	.....	.....	.....	6	.....	98 (7)
	4th	.....	.....	....	....	29 (2)	29 (1)	10 (2)	.....	...	.....	1	.....	.....	8	3	80 (5)
Total	.....	226 (2)	.....	....	....	90 (3)	112 (7)	46 (4)	.....	...	.....	1	3	.....	23 (1)	3	504 (17)
British Columbia	1st	226	.....	....	....	.....	.....	.....	.....	...	7	.....	.....	.....	.....	.....	233
	2nd	135	.....	....	....	.....	.....	.....	.....	...	7	.....	.....	.....	.....	.....	142
	3rd	.....	.....	....	....	12	20 (1)	31 (4)	.....	...	7	10	35 (1)	4	9	10 (1)	138 (7)
	4th	.....	.....	1 (1)	....	19 (1)	34 (3)	23 (1)	.....	...	6 (2)	9 (1)	55 (3)	4 (1)	5	6	162 (13)
Total	.....	361	.....	1 (1)	....	31 (1)	54 (4)	54 (5)	.....	...	27 (2)	19 (1)	90 (4)	8 (1)	14	16 (1)	675 (20)
Canadian Services Colleges																	
Royal Roads	1st	50	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	50
	2nd	40	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	40
Total	.....	90	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	90
Royal Military College	1st	62	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	62
	2nd	53	.....	....	....	.....	.....	.....	.....	...	.....	.....	.....	.....	.....	.....	53
	3rd	.....	.....	....	....	9	10	15	.....	...	.....	.....	24	.....	.....	.....	58
	4th	.....	.....	....	....	10	24	15	.....	...	.....	.....	16	.....	.....	.....	65
Total	.....	115	.....	....	....	19	34	30	.....	...	.....	.....	40	.....	.....	.....	238
Grand Total	.....	3743 (27)	50 (1)	2 (1)	1 (1)	639 (14)	1269 (85)	784 (61)	191 (4)	61 (4)	27 (2)	119 (3)	910 (75)	86 (3)	137 (7)	211 (5)	8230 (293)
Prospective 1953 Graduates	.....	.....	6 (1)	2 (1)	1 (1)	177 (10)	440 (56)	233 (39)	29 (4)	35 (3)	6 (2)	35 (2)	281 (50)	24 (2)	42 (6)	46 (2)	1357 (179)

†Alberta includes Petroleum Engineering, 2nd Year 16 (1), 3rd Year 12, 4th Year 18 (2).
NOTE—The figures shown in brackets indicate, in each case, the number of veterans included in the figure immediately preceding.

The Engineering Institute annual survey of student registration in engineering courses at Canadian universities as shown by the above tabulation includes for the first time, the registration in engineering at Memorial University of Newfoundland, St. John's, Newfoundland with a total of ninety (90) students in the first three years of the five-year course.

For the first time in several years, the total enrolment is up from the previous year. The total registration for 1951-2 was 7,509, but as indicated above, did not include the students at Memorial University. The total figure for 1952-3 is 8,230 so that the increase is 721 with the addition of those at Memorial, or 631 for only the universities listed last year.

First year registrations this year total 2,865 as compared to 2,105 in 1951 and 1,874 in 1950. On a percentage basis the increase for 1952 over 1951 is 34 per cent, after taking into account the first year registrations at Memorial University last year. The above figure compares most favourably with the 14 per cent increase last year over the first year enrolment of 1950. Incidentally, it will be noted that the number of ex-service veterans entering first year engineering has now dropped to 9, which of course is of no practical significance in relation to the total.

Overall registration of students in the graduating classes again shows an appreciable drop from the previous year. When reporting on last year's figures, the number of graduates anticipated for 1953 was approximately 1,450. This figure has now been reduced to 1,357, so that there will be about 360 fewer young graduates coming out next spring than there were in the spring of 1952. In this same connection it should be noted that the total registration this year of would-be 1954 graduates amounts to 1,325, and based on the shrinkage experienced between 1951 and 1952 classes, the actual number of 1954 graduates is almost certain to be less than 1,250. A further review of the above registrations indicates that 1954 will be the low point on the curve for numbers graduating, and that in 1955 the graduating classes should be larger than in either 1952 or 1953, although still well below the 1951 total.

The effect of these continuing smaller graduating classes on the employment situation will depend, naturally, on the state of general industrial activity during the next few years. If our business indices continue at the present high levels, the shortage of engineers is likely to become more and more serious.

Finally, the number of students registering in different courses continues to maintain almost identical proportions with only three or four minor exceptions.

The Scientists' and Engineers' Promise to American Life

by HERBERT HOOVER

An address given before the Centennial of Engineering, Chicago, Illinois, September 10, 1952

This celebration of 100 years of engineering demonstrates the progress of our profession without any verbal supplements.

We are proud of the past. But our minds are turned to what may come to America from our profession in the future years. But before I mention these great hopes I must make a few reservations. Progress in scientific discovery, invention, and their application will depend upon:

1. The maintenance of a climate of individual freedom of mind, spirit, and action from which alone they can spring.
2. To achieve that, this nation must keep out of wars, avoid inflation and unload these unbearable taxes. We might remember that ancient Athens, Rome, and some modern states by such practices bled white the intelligence and energies of their race.

The Promise of the Future

With this reservation I can say at once that the American people are on the threshold of a greater advance in living and comfort than ever known to mankind.

The promise of the scientists and engineers to America rests upon two foundations — the wider application of what we already know and the certainty of new discoveries and new inventions.

Even without any additional scientific discoveries or inventions we know these things:

The next generation will have less diseases and cure them faster than the last generation.

They will have less germs and insects to bite them.

They will have bigger and better food animals and plants, and less acres devoted to non-food products. Add to this more food from the sea, and there will be an abundance for our people.

Already known synthetic fibres will give the next generation better and cheaper clothes.

Our new knowledge of highway, air transport, and diesel engines will expand easier, cheaper, and safer transportation.

Our improved industrial methods and processes and bigger labor-saving tools will be more widely used. The next generation will control their machinery processes more and more precisely and with less labor by our already known electronic devices.

The next generation will have wider application of our new chemical and mechanical processes for extracting metals from low-grade ores. They will have more synthetic materials and thus more abundant and cheaper construction.

From all this we will have better and cheaper housing with all the gadgets.

Our new knowledge of electronics gives promise of ever-widening communication by radar, radio, and TV. The next generation may need endure still more singing commercials.

And they already know more about how to kill fellowmen than the past generation.

New Discoveries, New Inventions Also Would Come

Beyond all our accumulated knowledge which could be intensively applied by the next generation, we are assured of new discoveries in science and new inventions not now known. This is certain for several reasons. The next generation will have the advantages of already created better instruments and equipment for scientific research than the last generation.

Herbert Hoover (right), Hon. Mem. A.S.C.E., former president of the United States, is greeted by Carlton S. Proctor, president of A.S.C.E.

At this beginning of the hundred years we celebrate, there were but a few scattered laboratories in our universities and colleges. Today, America has more than five thousand effective laboratories — more than all the rest of the world put together. And in a hundred of them, each staff is greater than the personnel in all of them put together a hundred years ago.

There was a time when we got our new inventions from a poverty-impelled genius in the garret. That

time has long gone by. We have discarded a bread and water diet as the mother of invention. Our greater gifts from the last century came from long years of patient laboratory research and experiment by trained workers. We now have a new era in research by the co-ordination of teams of scientists who bring to our problems the combined knowledge of physics, chemistry, mathematics, and biology.

The result of scientific research in the future as in the past will be like the growth of plants, cell by cell. Some day there comes forth a new blossom of great scientific discovery, an illuminating hypothesis, a fruitful generalization or a new instrument for enlarged research.

From this increasing raw material of abstract science the engineer will bring still more inventions, still greater command of power, still new materials, and still more labor-saving devices, and new methods.

Out of his imagination, his blueprints, his construction will spring the new additions to human service and comfort, to leisure and recreation.

Some Illusions

But we are even today plagued with two persistent ghosts which haunt the lay mind. The first is the fright of technological unemployment. That ghost has been summoned from its lair every year since Eli Whitney invented the cotton gin. Yet for every job in the livery stable of yesterday, there are a hundred jobs in the garage of today at four times the take-home pay. Moreover, a study of our annual flood of patents shows that two-thirds of them are for production of new or better methods and articles of use and with new jobs. Further, a study of our comparative occupations over years shows that three times as many work people are recruited into new occupations as those whose jobs disappear in obsolescence.

The other truculent ghost of space writers is that our inventions and mechanization create degenerative physical pressures upon those who work them. The contrary is true. Our engineering results are accomplished by making our machines and heads work harder — not our hands.

Recovery from Lost Statesmanship

And the consequences of these advances produced by the scientists and engineers have another import.

From Watt's invention of the steam engine, down the long road of inventions to the latest electronic recorder, scientific discovery and the inventions by engineering productivity have periodically saved the world from impoverishment by the wars created through lost statesmanship. That is our hope for our nation today.

And let me add that bureaucracies do not produce these wonders in scientific discovery or invention. Governments can at times advantageously subsidize research or pioneering of the application of known discoveries.

However it is dynamic men and women, free in mind and spirit, who make these human advances. The decadence of scientific research in Germany under Hitler is a lesson to the world.

Contributions to Morals and the Spirit

There also lies in these fields of science and engineering a contribution to the moral and spiritual welfare of mankind. Here is the "inculcation of veracity of thought" in a world sodden with intellectual dishonesty. For science and engineering must first be expressed in words of truth, or they do not work. And from scientists and engineers comes the harmonizing of the individual to the pattern of his environment.

Above all they bring the confirmation of a Supreme Guidance in the universe far above man himself. √

Military Engineers' Annual Meeting

Report of the Annual Meeting, 1952, of the Military Engineers' Association of Canada

The 1952 annual meeting of the Military Engineers' Association of Canada took place at the King Edward Hotel, Toronto, Ont., October 15-17, 1952.

Lt.-Col. T. F. Howlett, E.D., of Toronto, president of the Association, acted as chairman and was assisted by his executive which consisted of: Maj.-Gen. G. R. Turner, C.B., M.C., D.C.M., past president, Ottawa; Lt.-Col. A. Webster, M.B.E., Vancouver; first vice president; Lt.-Col. R. J. Cassidy, O.B.E., Montreal, second vice president; Capt. H. M. Woodrooffe, Ottawa, honorary treasurer; Capt. G. A. Spear, Ottawa, honorary secretary; and the honorary colonel commandant of the R.C.E. Corps, Brig. J. L. Melville, C.B.E., M.C., E.D., Ottawa.

The delegates representing the various branches across Canada who were present at the meeting were as follows: Capt. J. S. Lilburn, Trail, B.C.; Capt. J. D. Taggart, Vancouver, B.C., Maj. E. J. Durnin, Regina, Sask.; Capt. W. B. Griner, Winnipeg, Man.; Lt.-Col. S. W Archibald, London, Ont.; Capt. S. Gusscott, Toronto, Ont.; Lt.-Col. J. F. J. Morazain, Montreal, Que.; Lt.-Col. D. L. Calkin, Halifax, N.S.

Visitors present at the meeting included the following: Cmdr. R. L. Dunsmore, Brig. C. P. C. S. Bright, Maj. A. C. Cooper, R.E., Lt.-Col. C. Bird, Maj. R. E. Johnstone, R.E., Col. G. R. Chetwynd, Col. A. J.

At the M.E.A.C. annual meeting, Toronto, 1952. Back row, left to right: Lt.-Col. J. F. J. Morazain, Capt. H. M. Woodrooffe, Capt. J. S. Lilburn, Lt.-Col. S. W. Archibald, Capt. J. D. Taggart, Lt.-Col. K. Clawson, Lt.-Col. D. L. Calkin, Capt. G. A. Spear, Maj. E. J. Durnin, Lt.-Col. E. M. Medlen, Capt. W. B. Griner, Lt.-Col. D. Berry, Lt.-Col. W. Abernethey. Front row, left to right: Lt.-Col. R. J. Cassidy, Lt.-Col. T. F. Howlett, Col. J. R. B. Jones, Lt.-Col. A. Webster, Brig. J. L. Melville, Capt. S. Gusscott, Lt.-Col. A. Anthes.

Kerry, Maj. D. M. M. Ross, Lt.-Col. R. Milne, Capt. R. Chambers, Brig. A. B. Connolly.

The chief engineer, Col. J. R. B. Jones, D.S.O., O.B.E., and his G.S.O. 1, Lt.-Col. D. Berry, were in attendance at all sessions to advise and answer questions.

The usual custom of honouring departed sapper officers of World War I was observed at the beginning of the meeting.

Wednesday afternoon was spent mainly in organization and preparation for the heavy sessions which followed in the next three days, while in the evening the delegates and members of the Toronto Branch, M.E.A.C., became better acquainted at a cocktail party held in the R.C.E. Mess, Fort York Armouries.

On Thursday morning, Maj.-Gen. S. F. Clark, C.B.E., C.D., quartermaster-general, representing the General Staff, Army Headquarters, briefly addressed the meeting and was then subjected to a barrage of questions hurled at him from all sides. This part of the meeting is always vital as the delegates are able to get direct answers to many of their questions concerning the Reserve Force and the Corps in general.

After General Clark retired from the meeting the chairman called for the reports of the various committees, and following their presentation the meeting adjourned.

During the dinner, miniatures of the six Association trophies were presented to representatives of the winning units. A miniature of the M.E.A.C. Challenge Trophy was presented by Lt.-Col. T. F. Howlett, president of the M.E.A.C., to Capt. W. Griner, who accepted it on behalf of 6 Fd. Engr. Regt., R.C.E., Winnipeg. The Gzowski Trophies, Eastern and Western, were won respectively by 56 Indep. Fd. Sqn., R.C.E., Newfoundland, and 31 Fd. Pk. Sqn., R.C.E., Winnipeg, and the miniatures were presented to the representatives of the units by Col. H. Gzowski, grandson of the original donor, Col. Sir Casimir Gzowski. Lt.-Col. D. Calkin accepted on behalf of the Newfoundland squadron and Major W. Griner on behalf of the Winnipeg unit. Brig. J. L. Melville, honorary colonel commandant, presented to Lt.-Col. R. Milne, officer commanding, 2 Fd. Engr. Regt, R.C.E., Toronto, the miniature of the Colonel Commandant Trophy. The miniature of the Hertzberg Memorial Trophy was presented to Lt.-Col. D. Calkin, representing 30 Fd. Pk. Sqn., R.C.E., Halifax, by Capt. P. Hertzberg, son of Maj.-Gen. Hertzberg, first chief engineer of the Canadian Army, World War II. The Lindsay Memorial Trophy, in memory of Maj.-Gen. W. B. Lindsay, chief engineer, Canadian Corps, World War I, was presented to the Association by Maj.-Gen. G. R. Turner on behalf of the sapper officers who served under the General in World War I. Lt.-Col. T. F. Howlett, president, M.E.A.C., accepted on behalf of the Association. Maj.-Gen. T. V. Anderson then presented the miniature to Lt.-Col. Archibald who was representing 7 Fd. Sqn., R.C.E., London.

The dinner was concluded in rousing style when Brig. Melville led the singing of the C.R.E.'s song.

On Friday morning the meeting was addressed briefly by Maj.-Gen. C. N. Tuck, C.B., O.B.E., engineer-in-chief, War Office, who expressed his gratitude at the warm reception he had received everywhere he went in Canada.

The next item on the agenda was the election of officers for 1952-53. The slate is as follows: president, Lt.-Col. A. Webster, Vancouver; past president, Lt.-Col. T. F. Howlett, Toronto; directors, Capt. B. S. Brown, Vancouver, and Major A. G. Shore, Vancouver; 1st vice president, Lt.-Col. R. J. Cassidy, Montreal; 2nd vice president, Col. M. Allan, Toronto; honorary secretary, Capt. G. A. Spear, Ottawa; honorary treasurer, Capt. H. M. Woodrooffe, Ottawa.

The new president, Col. Webster assumed the chairmanship and the delegates plunged into the heavy business of sorting out and voting on the many resolutions concerning the Reserve Force engineer units in particular, and the R.C.E. Corps in general.

Friday evening saw almost all of the sapper element in Toronto attending the Engineers Ball. The Toronto Branch, M.E.A.C., are again to be congratulated on the splendid show they had arranged.

The meeting concluded at noon Saturday with the election of representatives to the forthcoming meeting of the Conference of Defence Associations which is held in Ottawa sometime during the month of January. The results of the elections were as follows: Lt.-Col. A. Webster, president, M.E.A.C., Vancouver; Lt.-Col. D. Calkin, Halifax; Lt.-Col. R. Milne, Toronto, and Capt. G. A. Spear, Ottawa, honorary secretary.

1952 Building Officials Conference

The Fourth Building Officials Conference was held May 9 and 10 in Windsor, Ontario, under auspices of the Associate Committee on the National Building Code. The meeting was attended by 41 representatives of municipalities, two from provincial governments, eight from federal departments, four visitors from the United States, and eleven special guests, as well as members of the Associate Committee and chairmen of the Code Technical Committees. The meeting immediately preceded the annual meeting of the Building Officials Conference of America at Detroit, a number of delegates to each meeting being in attendance at both these conferences.

The discussion at the Windsor meeting showed clearly the demand which exists for the holding of such an annual conference of Canadian building officials. The Associate Committee therefore looks forward to arranging a similar meeting in the spring of 1953, probably at Ottawa.

R. F. Legget, chairman of the Associate Committee, described briefly the work now in progress on the Code. He recalled the Code had been printed in 1941, and after more than ten years it was badly in need of revision. During that time, at the express suggestion of building inspectors, the Code for Dwelling Construction had been written and now was in general use throughout Canada. Twenty-six thousand copies of building code documents had been issued by National Research Council. These included the National Code, the Code for Dwelling Construction, and other supplementary documents.

Presently more than 26 committees and panels, he said, were in operation, and some 180 architects, engineers, building inspectors, and others were actively engaged in revision work. Though the Code could not be completed for the Windsor meeting, progress on the revision was well advanced.

The initial draft on the Administration Section had been distributed and comments received and reviewed. A second draft would be issued. It was not intended, he pointed out, that this section should be adopted as a whole, due to vary-

ing conditions from province to province. It was agreed that a consolidated draft of all sections would be issued for comments. When the technical work on the revision was done, the chairman observed, there was a big task ahead in making the benefits of the Code known to all municipalities in Canada.

All sections of the Code were discussed. Committees and panels had prepared drafts for the greater part of the work. If specifications on which the Design Committee were depending were made available in time, he believed all drafts could be sent out by late summer and the Code completed by the end of the year.

During 1953, he suggested, secretaries Ferguson and Frigon of the Division of Building Research, N.R.C., should visit municipalities across Canada, to discuss with them the application of the new Code. Following this, publication of a medium sized Code would be considered.

General questions dealt with included trailers and the need for strict control of permits therefor, to prevent formation of slums. Lack of zoning was believed the chief cause of trouble with trailers. The question of making public information from permits contained in building inspectors' files was discussed. Other subjects considered included dry basements; lowest limit for permit fees; brick for siding and beam filling; vapour barriers; blown insulation; testing of foreign steel; approval of new materials; C.M.H.C. acceptance lists; fire escapes; exterior walls; and moisture content of lumber.

Architectural control over the appearance of buildings came up for lengthy discussion. Authority for a city to exercise this type of control, it was observed, came under Subsection 4 of Section 390 of the Municipal Act. Many comments were received from delegates on experience with such controls in various cities on the continent. The view that such regulations must be based on public health and welfare appeared to meet with general support.

In concluding the meeting, the chairman observed that a good building code was only useful to the extent that it was properly applied. When the new building for the Division of Building Research, N.R.C., Ottawa, was ready for occupancy next year, he pointed out, facilities would be available to accommodate training courses for inspectors. Much, he felt, could be gained by the use of modular co-ordination, viz., standardization of building unit dimensions so units of materials and assemblies could be co-ordinated with a minimum of cutting and fitting.

Inquiries regarding the activities of the Associate Committee should be addressed to the Secretary, the Associate Committee on the National Building Code, c/o Division of Building Research, National Research Council, Ottawa.

Good Roads Association Meets in Quebec

The 33rd annual convention of the Canadian Good Roads Association was held October 20th to 23rd inclusive, at the Chateau Frontenac in Quebec City. The meeting set an all-time record for the Association, with over 800 in attendance, including delegates from every province, thirteen states, as well as representatives from Britain, Italy and Germany. The Hon. Gaspard Fauteux, lieutenant governor of the Province of Quebec, welcomed delegates after an invocation by Abbé Maheux of Laval University.

Good Progress Reported by Managing Director

A substantial widening of its activities and marked improvement in the financial position of the Association was reported by C. W. Gilchrist, managing director. Referring to the three-point program recommended and adopted at the C.G.R.A. annual meeting two years ago, he reported that most of the activities then recommended had been implemented since that time.

The constitution and by-laws had been completely revised to give much broader representation on the Association's governing bodies. During the year to the date of the report, C.G.R.A. subscriber membership had increased by 69 per cent. This increase had been due to aggressive membership campaigns and the Association's public education and information activities.

Our Way of Life Depends on Roads

North America enjoys the highest standard of living in the world because of its mobility and system of roads which, in turn, give the continent a great capacity to produce manufactured goods, Hon. Merrill D. Rawding, president, told the opening session of the convention.

"No society functions and no nation becomes great without proper communications and transportation", he told the delegates. "The modern highly industrialized state derives its productive capacity and much of its character from the flexibility of its industrial plant and the wide movements of its population."

During the current year the provinces made substantial progress in extending and improving roads, Mr. Rawding related. Expenditures by the provinces on highways, excluding outlay on city streets, will total about $350 millions.

Construction and highway maintenance conditions across Canada were generally excellent. But much remains to be done to bring highways up to national needs, and it is the responsibility of C.G.R.A. to ensure, directly and indirectly, that everything possible will be done to meet the nation's needs for roads.

Governments, both provincial and municipal, are generally spending more today on roads than ever before. Mr. Rawding concluded that "road budgets cannot be increased greatly beyond their current levels", but he believed "we can advocate permanent and stable road building programs that will not be scrapped at the first sign of economic adversity."

Mr. Rawding stated that the aims and purposes of C.G.R.A. were simple. "The members of the Association, both the builders and the users of roads, are united in one conviction. The nation needs more and better roads. The primary aim of the Association's public relations policy, therefore, is to educate the citizen and the taxpayer to the advantage and necessity of adequate roads and streets."

Co-operation the Key to Better Highways

Better highways can be obtained by the co-operative efforts of both users and administrators, General Frank Merrill, commissioner of highways in the State of New Hampshire and wartime hero of the U.S. forces in Burma, told the Convention.

Highways were not built as "perpetual memorials", the General declared, but were meant for use and anything that is used wears and deteriorates. There should be a realistic appraisal of this fact by highway administrators and an increased

effort to attack and reduce the wear by better and advanced engineering techniques.

General Merrill described the activities of PAR—Project-Adequate Roads—in the United States and described the essential bases of a sound highway program advocated by PAR as:

1. Proper classification of roads into systems
2. Funds for adequate highway systems
3. Fair distribution of highway costs
4. Improved highway administration
5. Continuous programming, including a priority program of urgent needs based on sufficiency ratings.

Roads should be built and maintained on proved needs, not on any other grounds, General Merrill said. "Political considerations should have no part in highway problems. Administration, while most certainly subject to necessary supervision and regulation by the executive branch of the government it serves, should be entirely divorced from partisan politics."

Road builders and users must have some practical regard for the economics of the highways program, the speaker concluded. "The soundest highway program which anyone can devise will be that one which is the most technically adequate, yet within the practicable financial capacity of the government entity involved. Should any of us fail to recognize this we may be loyal to our highways and their needs, and still not be fulfilling our duty as good citizens."

C.G.R.A. Should Take Lead Toward Better Roads

The Canadian Good Roads Association is the "logical organization to take the initiative and lead the way toward better roads", William A. Wecker, O.B.E., president of General Motors of Canada Limited, told a luncheon meeting.

"As a matter of fact, your Association has already demonstrated the force and power of a popular movement", he declared. "Yet the problems now facing good roads movements dwarf those of the early days. The spirit of the revitalized good roads movement will have to be more staunch and aggressive than the old movement ever was."

The public, Mr. Wecker suggested, is interested and eager for a solution to the highway problem. "The public *does* want the solution to this highway problem," he declared. "People are ready to admit they are learning by bitter experience that inadequate roads are a bad investment. They are paid for partly by human lives, by property damage and by costly delays".

G. B. Williams to Head Idaho Observer Group

G. B. Williams, chief engineer of the Manitoba Department of Public Works, was named chairman of the C.G.R.A. Idaho Road Test Committee. A nationally-known specialist on soils mechanics, he will head the eight-man committee to observe and report upon the flexible pavement test being conducted at Malad, Idaho, under supervision of the U.S. Highway Research Board.

This project, known as the Washo (Western Association of State Highway Officials) Road Test, is jointly sponsored by the Bureau of Public Roads and the Highway Departments of eleven western states, at an estimated cost exceeding half a million dollars.

Principal objective of the project is to study the effect of various loadings and weights on a wide range of both rigid and flexible pavement section designs. The purpose is to establish more precise data for future design, and to evaluate limiting load carrying capacities of existing highways.

It is hoped from this, and other economic studies being undertaken by the Highway Research Board, to be able to determine at what point assumed savings in cost of truck operations with increase in size and weight, is offset by increased cost of highway provision. The availability of the information derived will be of inestimable value to Canadian highway officials and will ultimately save money for the Canadian taxpayer.

Highways Starved by Tax Diversion

"A threat to future highway development is the demand of cities and towns for larger and larger shares of highway use taxes", warned Fred B. Lautzenhiser of Chicago, a noted automotive consulting engineer. Commenting on the dispersion of tax funds derived from highway use, the speaker declared that in some localities primary highway systems are actually suffering because of the lack of funds with which to improve them.

"The demand for city and town sharing too often comes, not from persons interested in relieving traffic congestion in their respective cities, but from persons interested in shifting the burden of general taxation from real estate to the motor vehicle owner. These persons contend that highway users should pay the entire cost of constructing every mile of highways, roads and streets."

Mr. Lautzenhiser declared that a study of most city and town budgets will show that it is costing no more to construct and maintain city streets in proportion to the total budget now than it did 50 years ago. "The interesting thing is," he said, "that those who attempt to show what a burden the motor vehicle has placed on cities and towns never tell you about the contributions the motor vehicle has made in the way of creating new communities and building up real estate taxes". Garages, filling stations, automobile sales buildings, bus and truck terminals were among the many businesses paying substantial real estate taxes which had developed as automotive transportation had grown.

Provinces Report Record Road Building Activity

Reports from provincial representatives reveal a continued high level of activity in road building during the year, with no evidence that there will be any slackening in the near future.

Shortages continue to pose a problem, with some provinces reporting that they have overcome these difficulties, especially steel shortages, by the use of substitutes, particularly timber. Labor shortages, especially in engineers and skilled workmen, are now one of the provincial road builders' main problems.

Arthur Bergeron, deputy minister of the Quebec Department of Roads, reported a unique difficulty: because early French settlers built their homes close to the roads and close together for protection against Indians, it is necessary to buy expensive rights of way and buildings for new roads and widening old ones. Severe winter conditions have also cost this province dearly, running to about $3,500,000 a year for snow removal alone.

E. S. Jones, deputy minister of public works in British Columbia, stated that the province's magnificent scenery is an expensive luxury. Reconstruction of 1.1 miles in the Fraser Canyon cost $850,000, and other sections will be similarly expensive.

Without exception, the provinces stated that they were spending more on highways this year than in any other year in their history.

Roads are Pivot of National Security Says Army Engineer

Canada's roads system is in no condition to take the load of war, Colonel J. R. B. Jones, D.S.O., O.B.E., chief engineer of the Canadian Army, warned the delegates. National security is seriously prejudiced, Colonel Jones declared. "Our planning must include adequate roads for the possible expansion of war industries, movement of raw materials and agricultural products, commuting of war workers, the needs of civil defence and the free and rapid movement of the armed forces. New standards must be set for new roads and old roads must be brought up to these standards. The elimination of bottlenecks should receive a high priority. When the emergency arises", he said, "it will be too late to embark on a big road program; one must prepare for emergencies before they happen. That is the basic principle of security".

Hon. E. S. Spencer, president of C.G.R.A.

Experts Describe Sub-soil Treatment

Latest advances in sub-soil treatment were described by a group of experts. The discussion was led by Alan K. Hay, chief engineer of the Federal District Commission, Ottawa.

Mr. Schriever described the functions of the Associate Committee on Soil and Snow Mechanics and the work of the National Research Council in the field of soils mechanics. Mr. Bilodeay told the delegates of the work done on frost heaves with lignosol B in Quebec Province and in the stabilization of sand with clay. Professor Hurtubise also described work done in Quebec in soil stabilization with lignosol. Mr. Piette spoke on the bearing capacity of cohesive soils.

To Establish C.G.R.A. Research Division

Lyle H. Kain, chairman of the Operating Committee, reported that insufficient support was evident to establish the proposed Canadian Highway Research Institute on a full scale immediately.

A resolution was adopted by the annual general meeting, however, approving "an immediate start toward a national highway research program by establishing a division within the Association, with the objective of eventually developing it into the recommended Canadian Highway Research Institute when the necessary financial support would be forthcoming."

Mr. Kain said that the automobile and truck manufacturers, represented by the Canadian Automobile Chamber of Commerce, had promised substantial support for the research division, provided provincial governments and other industries also supported the project.

It was recommended by the meeting that the provincial governments draw up a program of proposed research projects for the new division, to be presented to the C.G.R.A. board of directors in the new year. Work on the division would be initiated as soon as the necessary financial support was forthcoming.

Privately-Sponsored Good Roads Campaign Suggested

A recommendation that the Association call a meeting to explore the possibilities of launching a privately-sponsored public information and publicity campaign for better roads was approved at the meeting. This action followed a report by the chairman of the operating committee that considerable support existed for the suggestion.

The managing director was instructed to call an early meeting of advertising and radio executives and business and government public relations representatives, to outline a campaign on the same pattern as that conducted in the United States by the PAR movement, where newspaper and magazine advertising and radio programs appealing for better roads are supported by private organizations.

Civil Defence Road Survey Asked by C.G.R.A.

That one of the first tasks of the new federal director of civil defence transport should be to "make a complete nation-wide survey of roads and road transport facilities so that there will be adequate preparations for the utilization of roads and road transport in the event of war," was recommended by the meeting.

In another resolution the annual general meeting commended the federal Department of Trade and Commerce for the road machinery and equipment display, held last year for the first time in conjunction with the annual Canadian International Trade Fair.

Incoming Executive

The Hon. E. S. Spencer, Minister of Public Works, Newfoundland, was elected as president of the Association for 1953. Other officers elected included ministers responsible for highways in each of the remaining nine provinces with the exception of Prince Edward Island and Ontario. A strong slate of directors, including some fifteen executives of contracting equipment and supply companies, was elected for the coming year.

News of Other Societies

The 1953 convention of the **Canadian Section of the American Waterworks Association** (Secretary - Treasurer, Albert E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ont.) will take place from April 6 to 8. Convention hotel will be the Statler, at Buffalo, N.Y.

The Association of Professional Engineers of Alberta announced in October, the appointment of Mr. Adrian E. McDonald, R.I.A., as executive secretary of the Association.

Establishment of a national Tool Engineering Research Foundation to carry out scientific research projects in the field of manufacturing processes, and allied tool engineering subjects has been announced by the **American Society of Tool Engineers** (10700 Puritan, Detroit 21, Mich.). Trustees elected recently by the board of directors of the Society, will arrange for the charter of the Foundation.

The American Welding Society (33 West 39th Street, New York,

N.Y.) will conduct a national spring technical meeting at the Shamrock Hotel in Houston, Texas, June 16 to 19, 1953. A four-day welding and allied industry exposition will take place concurrently.

The place of automatic computing equipment in industry will be the subject of a two-day symposium to be held in Kansas City, Mo., January 8 and 9. This meeting is sponsored by the **Midwest Research Institute** in co-operation with local sections of the American Society of Mechanical Engineers, The American Society of Civil Engineers, American Institute of Chemical Engineers, Instrument Society of America, American Institute of Electrical Engineers, Institute of Radio Engineers, and the Society of Automotive Engineers.

The Society of the Plastics Industry, Inc. (67 West 44th Street, New York 36) announces meetings for early 1953 as follows: the 8th annual S.P.I. reinforced plastics division conference, February 18-20, at the Shoreham Hotel, Washington, D.C.; the annual meeting and conference of S.P.I., taking place during a cruise to Bermuda, May 9-15.

The Highway Research Board of the U.S. National Research Council, invites attendance at the thirty-second annual meeting of the Board. The meeting will be at the building of the National Academy of Sciences and the National Research Council, Washington, D.C., January 13 through January 16, 1953.

At the annual meeting of the **Society of Naval Architects and Marine Engineers** (29 West 39th Street, New York 18, N.Y.) concluded on November 15, 1952, Mr. William E. Blewett, Jr., was elected president of the Society. Mr. Blewett, who is executive vice-president of the Newport News Shipbuilding and Dry Dock Company, succeeds Mr. J. H. King, vice-president of The Babcock & Wilcox Company.

The 19th annual meeting of the **American Society of Photogrammetry** (Box 18, Benjamin Franklin Station, Washington 4, D.C.) will be held on January 14, 15 and 16, 1953, at the Shoreham Hotel in Washington, D.C. The program will be highlighted by a panel on "Arctic Mapping" as a joint project of Canadian and American speakers and by a full day devoted to "Photo Interpretation" with its applications to the sciences, industry, and military intelligence.

Elections and Transfers

At the meeting of Council held at Temiskaming, Que., on November 8th, 1952, a number of applications were presented for consideration and on the recommendation of the Admissions Committee the following elections and transfers were effected:

Members:

A. J. G. Agnew, *Montreal.*
J. Albulet, *North Bay.*
A. H. Ashworth, *Vancouver.*
N. A. Burke, *Temiskaming.*
R. Clough, *Vancouver.*
C. R. Davis, *Toronto.*
E. R. Davis, *Toronto.*
C. N. Downing, *Toronto.*
C. K. Duff, *Toronto.*
R. A. Ellis, *Toronto.*
H. H. Engell, *Toronto.*
J. E. K. Foreman, *Niagara Falls.*
G. W. Govier, *Edmonton.*
H. R. D. Graham, *North Bay.*
R. C. Haisell, *Toronto.*
T. L. B. Hamlin, *Sudbury.*
C. D. Hayden, *Montreal.*
E. Hoel, *Toronto.*
M. G. Holmes, *Montreal.*
P. C. Kempe, *Three Rivers.*
J. S. L. King, *Toronto.*
J. R. Lewis, *Temiskaming.*
N. H. MacKinnon, *Sudbury.*
F. S. McCarthy, *Montreal.*
M. A. Moncrieff, *Montreal.*
R. G. Radley, *Montreal.*
A. R. Ramsey, *Montreal.*
F. R. Sharman, *Temiskaming.*
T. E. Smith, *Saint John.*
F. V. W. Sturman, *Montreal.*
R. Walsh, *Montreal.*
J. M. Whatley, *Montreal.*
C. W. Young, *Sherbrooke.*

Juniors:

A. R. Barbeau, *Montreal.*
D. Chmara, *Fort Erie.*
C. C. Dayton, *Windsor.*
R. L. Denison, *Kingston.*
E. D. Forsyth, *Sturgeon Falls.*
G. J. Fortiades, *Windsor.*
C. K. Hall, *Kapuskasing.*
K. J. Irwin, *Fort Erie.*
C. R. Lewis, *Toronto.*
W. W. A. McPhee, *Windsor.*
D. L. T. Oakes, *Montreal.*
B. W. Petronishin, *Toronto.*
W. H. Rempel, *Ft. William.*
J. W. Robinson, *Montreal.*
E. C. Walton, *Toronto.*

Transferred from the class of Junior to that of Member:

R. G. Dye, *Temiskaming.*
R. K. Eadie, *Montreal.*
J. W. N. Fead, *Evanston, Ill.*
J. B. Herbich, *Kitimat, B.C.*
G. D. Lewis, *Montreal.*
J. W. S. Rose, *Temiskaming.*
T. Sakellariou, *Hamilton.*
G. L. Schneider, *Hamilton.*
W. Tkacz, *Chicago, Ill.*

The following Students were admitted:

University of British Columbia

A. E. Allsebrook
J. D. Boulding
J. E. Brooks
W. E. Erlebach
E. J. Fjarlie
N. Mitchell
N. Moysa
J. C. MacDonald
J. D. McGuire
H. Palmer
G. A. Foulder
J. J. Gorkoff
E. G. Hannington
V. L. Isfeld
A. H. Johnson
J. F. Laing
C. W. Robinson
G. B. Spindler
J. T. Sullivan
J. D. Wood
A. A. Zaionchkovsky

Queen's University

J. R. Alexander
T. P. Baker
D. H. Campbell
H. R. Doan
R. K. Elliott
C. W. M. Fontyn
G. Garrett
E. R. Hilborn
M. Jakowec
A. C. Jamieson
G. K. Lee
A. Leiterman
J. R. Lewis
I. J. MacDonald
R. White
E. M. Yaremy
S. Szach

University of New Brunswick

G. R. W. Bliss
L. G. Boundy
R. F. Dee
R. E. Donkin
D. S. Duncan
H. R. Renfrew
G. A. A. Locke
G. C. L. McEnery
R. G. Read
P. E. Rouse
J. W. Stannix
C. R. Walker

University of Toronto

M. Y. Ansari
A. G. Ewart
D. J. Little
G. B. Nelson

Royal Military College

J. S. Bates
D. E. W. Bucher
A. J. A. Morrison

University of Alberta

J. Mekechuk
A. Nawata
K. F. Townsend
R. W. Van Alstyne

McGill University

D. Gaon
R. L. Wright

Nova Scotia Technical College

D. O. Outhouse
F. A. Villela

Laval University

J. Dorval

University of Manitoba

R. A. Johnson

Acadia University

C. A. Clements
J. C. MacDonald
A. R. Harvey, *Kapuskasing, Ont.*

Applications through Associations

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

Alberta

Member:
E. E. Moore

Junior to Member:
K. Madsen

Saskatchewan

Member:
H. Nicholson

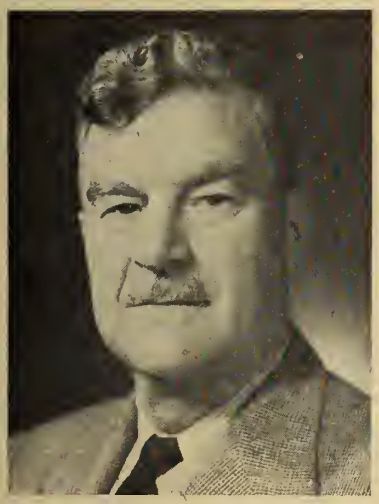
Junior to Member:
S. Harcus

Student to Junior:
W. C. Phillips

Personals

News of the Personal Activities of Members of the Institute

Major-General Howard Kennedy, M.C., C.B.E., M.E.I.C., of Ottawa, noted Canadian forestry engineer and well known Second World War officer, was apointed early in November chairman of the Federal District Commission, the honorary organization of eminent Canadians responsible for the carrying out of the long-range Master Plan for the suitable development of Ottawa as the National Capital of Canada.



Maj.-Gen. Howard Kennedy, M.E.I.C.

Since June of this year Major-General Kennedy has been a member of the National Capital Planning Committee, the permanent honorary advisory body to the F.D.C. on the implementation of the Capital Plan, and will continue his membership on the Committee by virtue of his new position.

General Kennedy graduated from McGill University in civil engineering in 1914.

He has a distinguished war record in two world wars. He served overseas with the Canadian Engineers in the First World War, being discharged with the rank of captain. At the beginning of the Second World War he went overseas again with the Royal Canadian Engineers and rose from company commander to officer commanding the First Division Engineers. He afterwards filled various staff appointments at National Defence Headquarters including that of quarter-master general.

In the years following the First World War, General Kennedy was employed by the E. B. Eddy Company and the Quebec Forest Industries as a forestry engineer and he returned to this profession after the Second World War. For a time he was vice-president in charge of woodlands for the Quebec North Shore and Ontario paper companies and in 1946 and 1947 he headed an Ontario Provincial Royal Commission to report on the conditions and needs of the forests of Ontario. Upon completion of the Royal Commission Report he entered practice as a consulting gengineer.

From April, 1950, to June, 1951, he was in the Middle East as director of United Nations Relief and Works Agency for Palestine Refugees.

In 1917 the Eastern Rockies Forest Conservation Board was organized with General Kennedy as its chairman and he has served in that capacity since and also as consultant to the Ontario Minister of Lands and Forests, as well as to many private companies.

C. K. McLeod, M.E.I.C., managing director of Walter Kidde & Company of Canada, Ltd., in Montreal, has been elected president of the Navy League of Canada. Mr. McLeod was formerly president of the Montreal division of the League.

Mr. McLeod is a former councillor of the Institute and a former chairman and secretary of the Montreal Branch.

Dr. J. R. Donald, M.E.I.C., has resigned as director of the chemicals and explosives division of the Department of Defence Production, Ottawa. Dr. Donald had been director general of the chemicals and explosives division of the Department of Munitions and Supplies from 1939 to 1945, and was recalled to government service in March, 1951, to assist in the organization of the Department of Defence Production. Since that date, the Canadian chemical industry has undertaken the largest expansion in its history, to provide a strengthening of Canada's economy as well as a broader base for military production. Dr. Donald will be returning to his position as president of J. T. Donald and Co. Ltd., in Montreal. The division will be disbanded, and the remaining problems in the chemical and explosives field will be handled by Dr. H. H. Saunderson, the coordinator of the Materials Branch

Albert Warren Howard, M.E.I.C., was recently appointed general manager of Calgary Power Limited.

Mr. Howard entered the Company upon graduation in electrical engineering from the University of Toronto in 1935, working there until 1939 when he joined the staff of the Montreal Engineering Company, consulting and operating engineers. In 1949 he returned to Calgary Power Limited.

Ian F. McRae, M.E.I.C., was recently appointed vice-president for the manufacturing, engineering and relations services division of the Canadian General

I. F. McRae, M.E.I.C.

Electric Company. With his new appointment comes the responsibility for achieving over-all company objectives in these fields through the five self-contained operating divisions recently established as a part of the Company's broad-scale decentralization program.

Mr. McRae entered the Company's Peterborough Works as an apprentice 27 years ago and has been engaged in the engineering and production of massive equipment for utilities and industry.

Mr. McRae is widely known throughout the electrical industry and has held important defence appointments during and since World War II.

Robert V. Macaulay, M.E.I.C., director and executive vice-president of the Bell Telephone Company of Canada, was recently honoured by the seven Canadian companies making up the Trans-Canadian Telephone System upon his retirement as chairman of the national system.

He was presented with an engraved silver plate by Mr. Peter Millar, general manager of the Manitoba telephone service.

Mr. Macaulay has been associated with the national network since its inception in 1932.

L. G. Trudeau, M.E.I.C., has been appointed vice-president and general manager of the Cementation Company (Canada) Ltd. with offices in Montreal. He comes to his new position after completing 45 years of service with the Department of Public Works.

Graduating from Laval University in 1907, Mr. Trudeau joined the Department as an assistant engineer at Montmagny. During his career he has had the honour of heading three districts, Rimouski, then Quebec, and finally, Ottawa.

E. W. R. Butler, M.E.I.C., has been appointed assistant manager of Bailey Meter Company Ltd., according to an announcement by A. L. Stewart, M.E.I.C., vice-president and manager.

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Mr. Butler joined the Company after graduating from McGill in 1924. Until his recent promotion he was manager for Western Canada with headquarters at Winnipeg.

W. A. Nelson, M.E.I.C., has been appointed manager of the Winnipeg office of Bailey Meter Company Limited, according to an announcement by A. L. Stewart, M.E.I.C., vice-president and manager.

A 1937 Queen's University graduate in mechanical engineering, Mr. Nelson has been a member of the Toronto office staff since 1946 following war service with the Royal Canadian Electrical and Mechanical Engineers.

Prior to his appointment he was sales service engineer.

T. C. Anderson, M.E.I.C., manager of the Thunder Bay Division of Abitibi Power & Paper Company Limited, has been appointed chairman of the Lakehead Branch of the Engineering Institute.

Upon graduation in civil engineering from the University of Toronto in 1929, Mr. Anderson joined the general plant engineering department of the Abitibi Power & Paper Company at Iroquois Falls. From 1935 until 1940 he was employed in the company's subsidiary, the Thunder Bay Paper Company Limited in Port Arthur.

T. C. Anderson, M.E.I.C.

Mr. Anderson joined the R.C.A.F. in 1940, and upon his discharge with the rank of wing commander in 1946, he returned to the Thunder Bay Company Limited in Port Arthur as production engineer. Within a few months he was appointed general superintendent of the Company.

He became assistant manager of the Thunder Bay Division of Abitibi Power & Paper Company Limited in 1947 and in July of this year he was appointed to his present position.

Mr. Anderson is a member of the Association of Professional Engineers of Ontario.

H. C. M. Gordon, M.E.I.C., was appointed vice-president of Dominion Steel & Coal Corp. Ltd., Sydney, N.S., several months ago.

Prior to his appointment he was general manager of coal operations division of the Company.

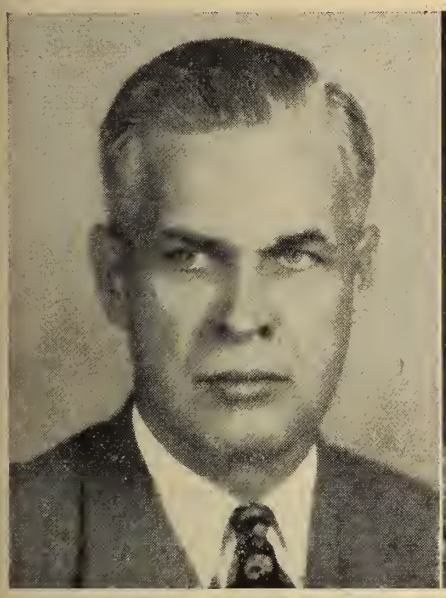
Mr. Gordon graduated in mining engineering from McGill University in 1923.

In March of this year he was awarded the Inco Platinum Medal for his "distinguished service to the mining and metallurgical industry".

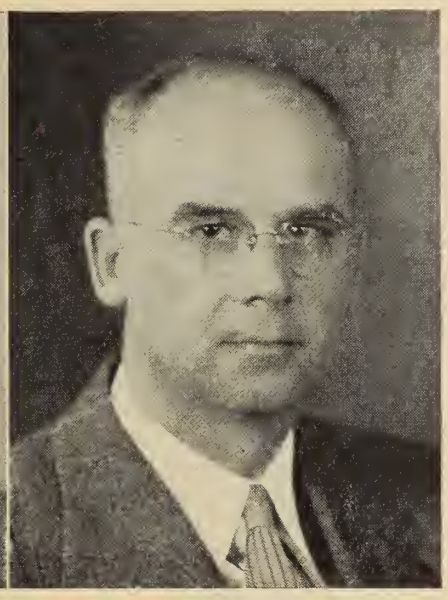
J. C. Neufeld, M.E.I.C.

J. C. Neufeld, M.E.I.C., has been elected chairman of the Lethbridge Branch of the Engineering Institute. He has been the city engineer at Lethbridge since January 1951.

He was previously regional services engineer in charge of design and construction of municipal services for Central Mortage and Housing Corporation, Vancouver, dealing with low rental housing for war veterans and other Department of National Defence projects in British Columbia.



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



W. A. Nelson, M.E.I.C.

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A 1931 civil engineering graduate of the University of Manitoba, Mr. Neufeld was with the City of Winnipeg for 12 years on structural design work and municipal engineering. During World War II he was with the Air Training Command, D.N.D., on construction of sewer and water systems.

He is a member of the Association of Professional Engineers of Alberta; the Western Canada Water and Sewage Conference; Canadian Institute on Sewage and Sanitation; American Waterworks Association; and the American Concrete Institute. He is also a member of the Rotary International Club and the National Geographic Society.

A. St. C. Ryley, M.E.I.C., was appointed vice-president of the Canadian Bridge Co. Ltd., Walkerville, Ontario, several months ago.

Mr. Ryley was general manager of the Walkerville plant since 1946, and general manager of the Company's Windsor plant from 1941 to 1946.

He is a 1910 civil engineering graduate of McGill University.

A. B. Olson, M.E.I.C., past president of the Association of Professional Engineers, past chairman of the Saskatchewan Branch of the Institute and superintendent of the Saskatchewan Power Corporation, has moved to Toronto. He is assistant superintendent of the Ontario Hydro Commission's brand new Richard L. Hearn steam station.

A graduate of the University of Saskatchewan in 1931, Mr. Olson has served since then in the North Battleford and Saskatoon plants of the Saskatchewan Power Corporation.

P. A. Pasquet, M.E.I.C., has been appointed chairman of the Niagara Peninsula Branch of the Engineering Institute.

Mr. Pasquet graduated in civil engineering from Queen's University, receiving his B.Sc. degree in 1942.

Since that time he has been on the staff of the H. G. Acres & Company and has worked on the Shipshaw development, Polymer Corporation steam plant, and more recently on the mechanical design of the J. Clark Keith generating station for the Hydro-Electric Power Commission of Ontario.

P. A. Pasquet, M.E.I.C.

A. V. Armstrong, M.E.I.C., was recently elected president and managing director of Amalgamated Electric Corporation Limited, at a board of directors meeting at Montreal.

Well-known in electrical circles, Mr. Armstrong joined Amalgamated Electric in 1938 as sales manager, Montreal Control Division. A Montrealer by birth and a 1923 McGill graduate in electrical engineering, he has since served as general sales manager, assistant to the vice-president, general manager and latterly as vice-president and managing director of Amalgamated Electric.

Mr. Armstrong worked earlier with the Canadian Cutler-Hammer Limited in Toronto as sales manager; with the Northern Electric Company in Toronto as manager of the power apparatus and special products for the Ontario division; and with the English Electric Company of Canada Limited, Toronto.

A. V Armstrong, M.E.I.C.

F. E. Regan, M.E.I.C., has been appointed vice-president of Bepco Canada Limited. Until his recent appointment he was Ontario branch manager in Toronto.

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Mr. Regan's engineering career has been associated solely with Lancashire Dynamo & Crypto, and Bepco, dating back to 1925 when he graduated in electrical engineering from Royal Salford

F. E. Regan, M.E.I.C.

Technical College in England. He served an apprenticeship course at Lancashire's Trafford Park Works, and was moved to Canada in 1927 as sales engineer for Lancashire Dynamo. In 1932 he was moved to that firm's Toronto office as assistant manager and, after Bepco was formed in 1933, Mr. Regan was appointed Ontario branch manager, a title which he has held to the present time. In 1950 he was added to the board of directors.

B. I. Burgess, M.E.I.C., was, in August, named manager of the meter department of the Canadian General Electric Company Limited, Toronto. Mr. Burgess has been previously with the Company

B. I. Burgess, M.E.I.C.

at Quebec City and with the switchgear engineering division in Peterborough, Ont.

J. Klassen, M.E.I.C., has opened consulting engineering offices in Ottawa. He was formerly with McDougall & Friedman, consulting engineers in Montreal, and earlier was chief engineer of Engineering Installations Ltd. Mr. Klassen graduated in chemical engineering from the University of Saskatchewan in 1943.

Cmdr. John Deane, R.C.N., M.E.I.C., is principal naval overseer of Marine Industries Ltd., Sorel, Que., where his duties include direction of mechanical, electrical and ship construction overseers. He comes to Sorel from the electrical school, H.M.C.S. Stadacona, Halifax.

Cmdr. Deane graduated from the University of British Columbia in electrical engineering in 1934.

H. G. Ambrose, M.E.I.C., has joined The Cooksville Company in Toronto as engineer in the precast division. He was previously associated with the Toronto consulting engineering firm of Gore and Storrie.

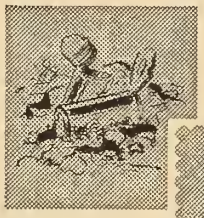
Mr. Ambrose graduated in mining engineering from the University of Toronto in 1942.

Dennis H. Lynch, M.E.I.C., is vice-president and managing director of The York Enterprises Inc., Gaspe, Que. He was previously electrical engineer with the Quebec Iron and Titanium Corp., North Shore, Que.

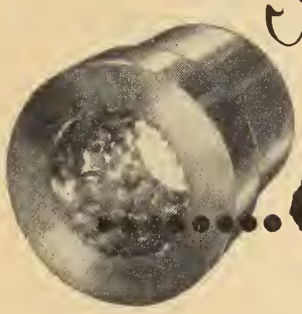
Mr. Lynch graduated in electrical engineering from the University of New Brunswick in 1936.

M. J. Oldershaw, M.E.I.C., is now supervisor of industrial consulting in the research, consulting and microwave department of the Canadian Marconi Company, in Montreal. He was previously consulting engineer in the company's electronics department.

GARBAGE...



Ice Cream...



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Mr. Oldershaw graduated in electrical engineering from the University of Toronto in 1945.

R. J. Merritt, M.E.I.C., has joined the staff of the materials and processes engineering group of the Trans-Canada Air Lines in Winnipeg. He was formerly with the Provincial Department of Health in Toronto.

He was, earlier, manager of the Electric Steam Radiator Company of Canada Limited in Windsor.

Mr. Merritt graduated in metallurgical engineering from the University of Toronto in 1941.

G. R. Davis, M.E.I.C., is now general manager and chief engineer of the Ottawa Hydro-Electric Commission. Formerly assistant general manager, Mr. Davis has held the positions of operating department engineer and superintendent of substations for the Commission. Mr. Davis is a 1927 electrical engineering graduate of Queen's University.

A. S. Lowe, M.E.I.C., a partner of Sandford Fawcett & Partners, Westminster, England, who was recently visiting in Canada, has advised that his firm has concluded a working arrangement with Messrs. Main, Rensaa & Minsos of Edmonton. The Canadian company and the British firm will combine to offer consulting service in a wide field.

C. W. E. Locke, M.E.I.C., has been appointed general manager of the pulp department of MacMillan & Bloedel Limited in Nanaimo, B.C. He was previously chief engineer of Bloedel, Stewart & Welsh Company, Port Alberni, B.C.

Mr. Locke graduated from the University of British Columbia in mechanical engineering in 1930.

J. Stuart Johnston, M.E.I.C., has been appointed district manager of the Dominion Oxygen Company Ltd., with headquarters at Winnipeg.

Mr. Johnston has been connected with Dominion Oxygen Co. Ltd., since before his graduation from McGill University in 1940. In 1947 he was appointed manager of the process service in the Montreal District.

J. S. Johnston, M.E.I.C.

John E. Stott, M.E.I.C., has opened consulting offices in Wallaceburg, Ont. He was formerly chief engineer for the Wallaceburg Brass Ltd. Mr. Stott is a 1938 mechanical engineering graduate of the University of Toronto.

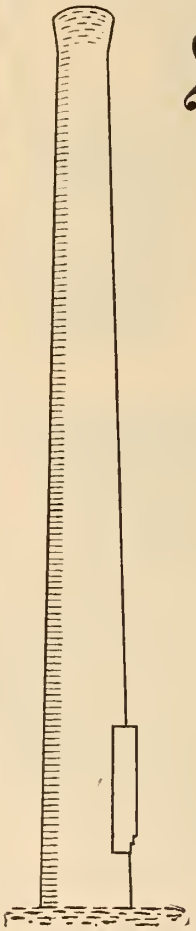
John E. Stott, M.E.I.C.

Duncan McIntyre, M.E.I.C., has been transferred by the special projects division of the Department of Transport in Ottawa to the Montreal office.

Before joining the Department of Transport, Mr. McIntyre was design engineer for the Prairie Farm Rehabitation Act engineering office in Regina.

He graduated from the University of Saskatchewan in civil engineering in 1946 and received his M.Sc. degree from the University of Wisconsin in 1948.

G. Ross Maitland, M.E.I.C., has recently accepted a position in the research and



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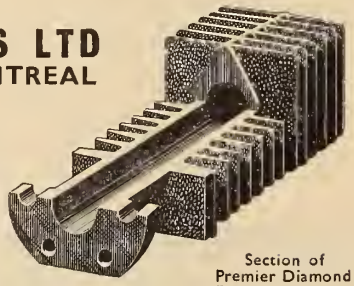

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development department of the Barrett Division of Allied Chemical and Dye Corp. in Philadelphia, Pa.

Mr. Maitland was previously research scientist for Defence Research Board at the Naval Research Establishment at Halifax.

He is a graduate in chemical engineering from the Nova Scotia Technical College, receiving his degree in 1949.

Oscar Duskes, M.E.I.C., is now resident engineer for Canadian National Railways in Jasper, Alberta. He was previously district storekeeper in Montreal. Mr. Duskes is a 1937 mining engineering graduate of McGill University.

A. G. Kaneen, M.E.I.C., is now associated with H. A. Simons, consulting engineers in Vancouver. He was previously with the Riverside Iron & Engineering Works, Calgary.

Mr. Kaneen is a 1944 mechanical engineering graduate of the University of British Columbia.

I. F. Ronalds, M.E.I.C., has joined the engineering department of the Foundation Company of Canada in Toronto. He was previously construction manager at Anfo Steel Corp. Ltd., Toronto; and project engineer with the Ontario Hydro Commission in Toronto.

Mr. Ronalds graduated from the University of New Brunswick in civil engineering in 1941.

George Perris, M.E.I.C., has been transferred from the nylon division of Canadian Industries Limited in Montreal to Maitland, Ont.

Mr. Perris joined the Canadian Industries Limited in 1947 and has served as chemical engineer in the Company's plants at Copper Cliff, Ont., and at Cornwall, Ont.

He received his B.A.Sc. degree from the University of British Columbia in 1946 and his M.A.Sc. degree in 1947.

Maurice J. Magnan, M.E.I.C., has been transferred to the Winnipeg Refinery from Montreal by the Imperial Oil Limited. He is a 1943 graduate in civil engineering from Ecole Polytechnique, Montreal.

T. C. Macnabb, Jr., M.E.I.C., is now assistant district engineer for the Canadian Pacific Railway Co. in North Bay, Ont. He was formerly special engineer with the Canadian Pacific Railway Company in Toronto.

Mr. Macnabb is a 1940 civil engineering graduate of the University of Manitoba.

L. H. Burpee, M.E.I.C., is now with the special projects branch of the Department of Transport in Montreal. He was formerly with Northern Construction Co. in Vancouver.

Mr. Burpee is a 1925 graduate of the University of Toronto.

Jean Horia Marica, M.E.I.C., has joined the staff of the civil engineering department of the Montreal Engineering Company Limited.

A 1942 graduate in civil engineering from Ecole Nationale des Ponts et Chaussées, Paris, Mr. Marica has been design engineer with the Rumanian National Railways, Bucharest; assistant chief engineer with C.R.S.A.R. general contracting company, Bucharest; and design engineer and branch manager with the S.A.E.E. consulting engineering firm in Paris, France.

G. C. S. Johnston, M.E.I.C., is now resident engineer for the City of Winnipeg. He was previously resident engineer for Greater Winnipeg Dyking Board.

J. W. Preboy, M.E.I.C., has been transferred by the Asbestos Corporation Limited, from Matheson, Ont., to Thetford Mines, Que. Mr. Preboy was previously construction and design engineer at the Company's British Canadian mine at Black Lake, Que. He is a 1942 graduate in mining engineering from the University of Alberta.

John A. Zalite, M.E.I.C., has been promoted by Canadian Vickers Limited, Montreal, to head the steel section of the marine drawing office.

Mr. Zalite received his mechanical engineering degree from the University of Latvia in 1934.

John R. Stuebing, JT.E.I.C., is on the staff of the combustion department of A. V. Roe Canada Limited, Toronto. He was previously with Page-Hersey Tubes Ltd., Welland, Ont.

Mr. Stuebing received his B.A.Sc. degree in mechanical engineering from the University of Toronto in 1950.

Peter Philip Saldat, JT.E.I.C., is design engineer with the consulting engineers H. G. Acres & Co., Niagara Falls. He was formerly with Canadian Cellucotton Products Co. Ltd., Niagara Falls. Mr Saldat is a 1951 University of Saskatchewan graduate in mechanical engineering.

H. G. Rindress, JT.E.I.C., is on the staff of J. P. Porter Company Limited, general contractors in Montreal. He was previously with the Department of Public Works in Halifax and Ottawa. Mr. Rindress is a 1948 civil engineering graduate of McGill University.

Arthur A. Brooks, JT.E.I.C., has been appointed to assistant planning engineer for the Ontario Hydro-Electric Commission in Toronto. He entered the Commission in 1949 following graduation in electrical engineering from the University of Toronto.

Joseph Arsene Roach, S.E.I.C., is now associated with the Department of Public Works at Quebec City. He was for-

E. I. C. TECHNICAL PAPERS

To supplement the technical data published in *The Engineering Journal* the Institute has established a fund to provide for the separate printing of specialized technical papers. These papers are published in pamphlet form for distribution at cost or less. Announcement of new technical papers appears in *The Engineering Journal.*

These technical papers constitute a record of engineering development in Canada and, in addition to circulation among E.I.C. members, are supplied to technical societies and libraries in all parts of the world.

The Publications Committee of the Institute invites members to submit manuscripts for consideration for *The Engineering Journal* or for separate publication.

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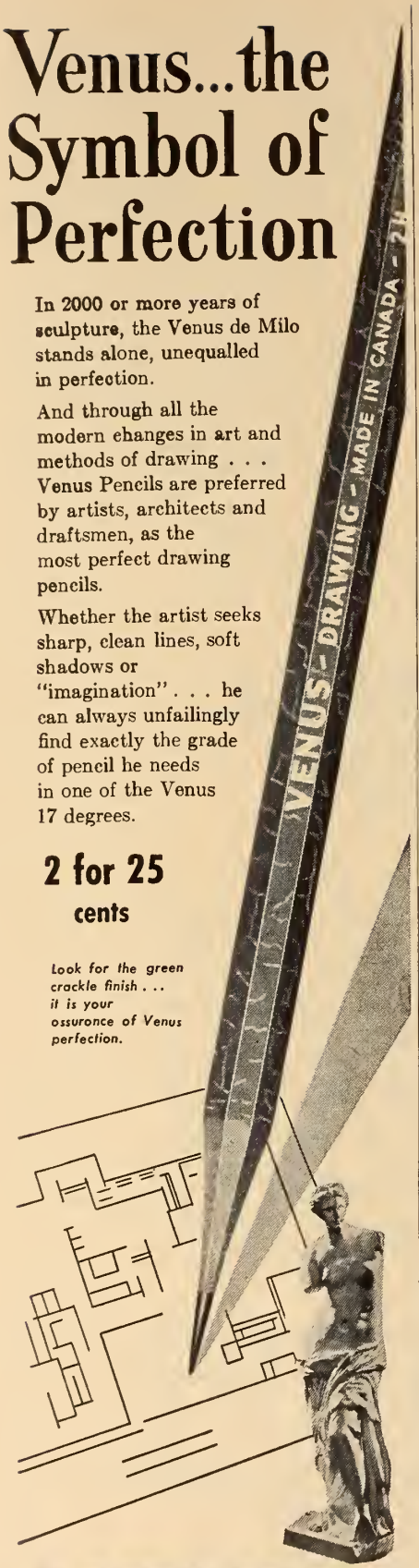

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merly development assistant with I. D. Ritchie Consolidated Works, Shawinigan Falls, Que. Mr. Roach graduated in civil engineering this year from the Nova Scotia Technical College.

Reginald Leo Farrell, JR.E.I.C., is now employed with the Turnbull Elevator Company in Toronto. He was previously a junior engineer on the staff of the Northern Electric Co. Ltd., Montreal. Mr. Farrell is a 1950 graduate in electrical engineering from the Nova Scotia Technical College.

Dr. James Y. Wong, JR.E.I.C., is now with the radio and electrical engineering division of the National Research Council. He was formerly engaged in electrical engineering research at the University of Illinois. Dr. Wong graduated in electrical engineering from the University of Manitoba in 1948.

E. A. Beaumont, JR.E.I.C., has been transferred to Lillooet, B.C., as district engineer for the British Columbia Department of Public Works. He was previously resident engineer for the department's branch at Fruitvale, B.C.

Mr. Beaumont is a 1949 civil engineering graduate of the University of British Columbia.

Edward O. LaFontaine, JR.E.I.C., is now chief of party with Fraser-Brace-Terminal Constructors, Saint John, N.B. He is a 1950 civil engineering graduate of the University of Toronto.

Samuel S. Lazier, JR.E.I.C., is now employed with the Pulp and Paper Research Institute of Canada as associate hydraulic engineer on a study of pulpwood holding ground.

Mr. Lazier was previously instructor in mechanical engineering at the University of Toronto where he received his B.A.Sc. degree in mechanical engineering in 1949 and his M.A.Sc. degree in 1951.

S/L C. E. F. Underwood, R.C.A.F., JR.E.I.C., is now associate professor in the department of civil engineering at the Royal Military College, Kingston, Ont. He was previously at the R.C.A.F. Station Greenwood, Kingston, N.S. S/L Underwood is a 1948 civil engineering graduate of the University of British Columbia.

C. J. LeBlanc, JR.E.I.C., is engineering assistant on the staff of the Maritime Telegraph & Telephone Company in Halifax. He was formerly junior engineer with the Northern Electric Company Limited.

Mr. LeBlanc graduated in electrical engineering from the Nova Scotia Technical College in 1950.

D. A. Dolan, JR.E.I.C., has joined the staff of Imperial Oil Company Ltd., in Montreal, as utility assistant. He was formerly with the Canadian General Electric Company in Toronto.

Mr. Dolan graduated in electrical engineering from the University of Saskatchewan in 1950.

Cleophas Amirault, JR.E.I.C., is now relay engineer in the generating and transmission department of the Southern Canada Power Company Ltd., Drummondville, Que.

Mr. Amirault graduated with a B.A.Sc. degree in 1950 from Laval University and has worked with the Southern Canada Power Company in Montreal.

J. C. Stewart, JR.E.I.C., has joined the staff of the engineer-in-chief of the steam power section at Naval Headquarters in Ottawa. He was formerly employed by the Department of National Defence, inspection services in the ships and general engineering division at Ottawa. He is a 1949 mechanical engineering graduate of Queen's University.

Frank J. Manherz, JR.E.I.C., has transferred his consulting offices from Windsor to Toronto. He graduated in civil engineering from McGill University in 1949.

Jacques Brisson, JR.E.I.C., formerly with A. R. Wilson Ltd., has recently been appointed manager of Briere and Bisson Ltd., Sherbrooke, Que. Mr. Brisson graduated in civil engineering from McGill University in 1950.

G. R. Seviour, JR.E.I.C., has joined the staff of Canadian Resins and Chemicals Ltd., at Shawinigan Falls, Que. He was previously with Anglo-Newfoundland Development Co. in Grand Falls, Nfld.

Upon graduation in 1949 from the Nova Scotia Technical College, he joined the engineering department of Canadian Industries Ltd., Montreal.

A. G. Steele, JR.E.I.C., is now associated with the International Business Machines Co. Ltd., as a production engineer. He joined the Company upon graduation in 1950 in electrical engineering from the University of Manitoba.

Murray S. Tempest, JR.E.I.C., is in the mechanical department of the Imperial Oil Limited at the Edmonton Refinery, Edmonton, Alta.

Mr. Tempest graduated in civil engineering from the University of Alberta in 1950.

William Johnston Perdue, JR.E.I.C., is associated with the Power Plant Contractors Limited, Toronto. He is a mechanical engineering graduate of the University of Manitoba, 1950.

G. A. M. Burton, S.E.I.C., is now on the staff of the Atomic Energy of Canada Limited at Chalk River. He is a 1952 graduate in chemical engineering from the University of Toronto.

James C. Newby, S.E.I.C., is associated with Structural Engineering Services in Edmonton. He graduated this year in civil engineering from the University of Alberta.

Robert Pogontcheff, S.E.I.C., is now associated as junior engineer with the Shell Oil Company of Canada in Calgary. He received his B.A.Sc. in 1950 and his M.A.Sc. degree this year from the University of Toronto.

Selby H. Noel, S.E.I.C., is assistant mechanical engineer with the Canadian National Railways in Moncton. He is a graduate this year of the Nova Scotia Technical College.

A. L. Eisenhauer, S.E.I.C., is employed as mechanical engineer with the Canadian Industries Limited, Montreal. He is a 1951 graduate in mechanical engineering of the Nova Scotia Technical College.

C. R. Nash, S.E.I.C., is now in the machine design department at Harry Ferguson Inc., Detroit, Mich. He was previously with the Ford Motor Company of Canada, Windsor, Ont.

Mr. Nash graduated in mechanical engineering in 1950 from the University of Manitoba.

J. P. Mosher, S.E.I.C., is on the staff of the head office of the Shell Oil Company

of Canada in Toronto. He is technical assistant in training to the lubricants manager. Mr. Mosher is a 1952 McGill University graduate in mechanical engineering.

B. W. Allen, S.E.I.C., is presently employed by the Department of Public Works of Canada in London, Ont. He graduated this year in civil engineering from Queen's University.

L. A. Neil, S.E.I.C., is presently employed by the National Research Council as junior research officer at the University of British Columbia where he is working on the Fraser River Model.

Mr. Neil is a 1952 mechanical engineering graduate of the University of Toronto.

Georges H. Lachance, S.E.I.C., is now development engineer with the Canadian Armament Research & Development Establishment at Valcartier, Que. He graduated this year in chemical engineering from Laval University.

R. C. Godding, S.E.I.C., is associated with Instruments Ltd., Ottawa, as design engineer. He was previously with Computing Devices of Canada, Ottawa. Mr. Godding graduated in mechanical engineering from Queen's University in 1951.

F. D. Malloch, S.E.I.C., is now with the wire and cable division of the Northern Electric Company, Ltd., Montreal. He graduated in mechanical engineering from Queen's University last year.

Lieut. R. F. Bryant, R.C.E., S.E.I.C., is works officer of the No. 18 Works Company at Fort Churchill, Man. He is a 1951 civil engineering graduate of the University of British Columbia.

G. Forth, S.E.I.C., has accepted a commission in the Canadian Army and is now serving a one-year tour of duty in Korea with the 23rd Field Squadron, R.C.E., and will continue his studies in chemical engineering at the University of Toronto on his return.

Lawrence L. Earley, S.E.I.C., is with the Canadian National Railways in Montreal. He was formerly with the International Nickel Company of Canada Ltd. in Sudbury, Ont. Mr. Earley graduated in electrical engineering from the Nova Scotia Technical College in 1951.

Ted Ferley, S.E.I.C., has accepted a position in the sales engineering department of Canadian Pratt & Whitney Company, Longueuil, Que. Mr. Ferley graduated in mechanical engineering from the University of Manitoba in 1952.

Visitors to Headquarters

W. S. Pardoe, M.E.IC., Marion, Pa., U.S.A., November 3rd, 1952.

D. E. Hibbard, M.E.I.C., Leamington, Ont., November 4th, 1952.

D. Law, Ottawa, Ont., November 5th, 1952.

J. A. Tames, M.E.I.C., Montreal, Que., November 5th, 1952.

J. P. R. Cristel, M.E.I.C., Montreal, Que., November 5th, 1952.

C. E. Weyman, M.E.I.C., Fredericton, N.B., November 13th, 1952.

E. P. Muntz, M.E.I.C., Hamilton, Ont., November 13th, 1952.

J. B. Hayes, M.E.I.C., Halifax, N.S., November 14th, 1952.

Obituaries

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

William E. Bown, M.E.I.C., of Montreal, who was vice-president of Dominion Steel and Coal Corporation, Ltd., died on October 28, in hospital in Montreal.

Mr. Bown was born at Sydney, N.S., in 1902. He received his early education in Sydney, and studied engineering at Acadia University and McGill University, graduating from McGill in 1923.

He had worked during vacations for Dominion Steel and Coal Corporation from 1917, and he was appointed assistant superintendent of the coke oven department of the Company in 1924. Six years later he became assistant general superintendent of the Sydney Steel

William E. Brown, M.E.I.C.

Works of DOSCO. In 1944 he came to Montreal as general manager of the Canadian Tube and Steel Products, Ltd., and in 1948 received the appointment as vice-president of Dominion Steel and Coal Corporation.

Mr. Bown joined the Institute as a Student in 1921, transferring to Associate Member in 1930, and to Member in 1940. He held membership also in the Corporation of Professional Engineers of Quebec.

Eldridge Burton Pearce, M.E.I.C., who died in hospital in Ottawa on October 11, 1952, after a short illness, was associated with Atomic Energy of Canada Limited as a senior design engineer.

Mr. Pearce was born at Sprucedale, Ont., in 1915, and graduated from Queen's University in 1940, in mechanical engineering.

His first position after graduation was with Horton Steel Works as a draughtsman. Transferring to Canadian Car and Foundry Co. Ltd., after a year, he was a tool draughtsman in 1941 and 1942, working later on tool planning and control until 1944. He served with the R.C.E.M.E. from 1944 to 1946, after which he worked for Babcock-Wilcox & Goldie-McCulloch as a draughtsman, and with S. A. Armstrong Ltd., as a combustion control equipment engineer.

In 1948 he was appointed to the National Research Council Atomic Energy Project at Deep River, Ont., as a design engineer.

Mr. Pearce joined the Institute in 1940 as a Student, transferring to Junior in 1942 and to Member in 1950. He was a member of the mechanical and industrial section of the Association of Professional Engineers of Ontario.

Konstantin Linde, M.E.I.C., passed away on September 30, 1952, at Corner Brook, Nfld., after a short illness.

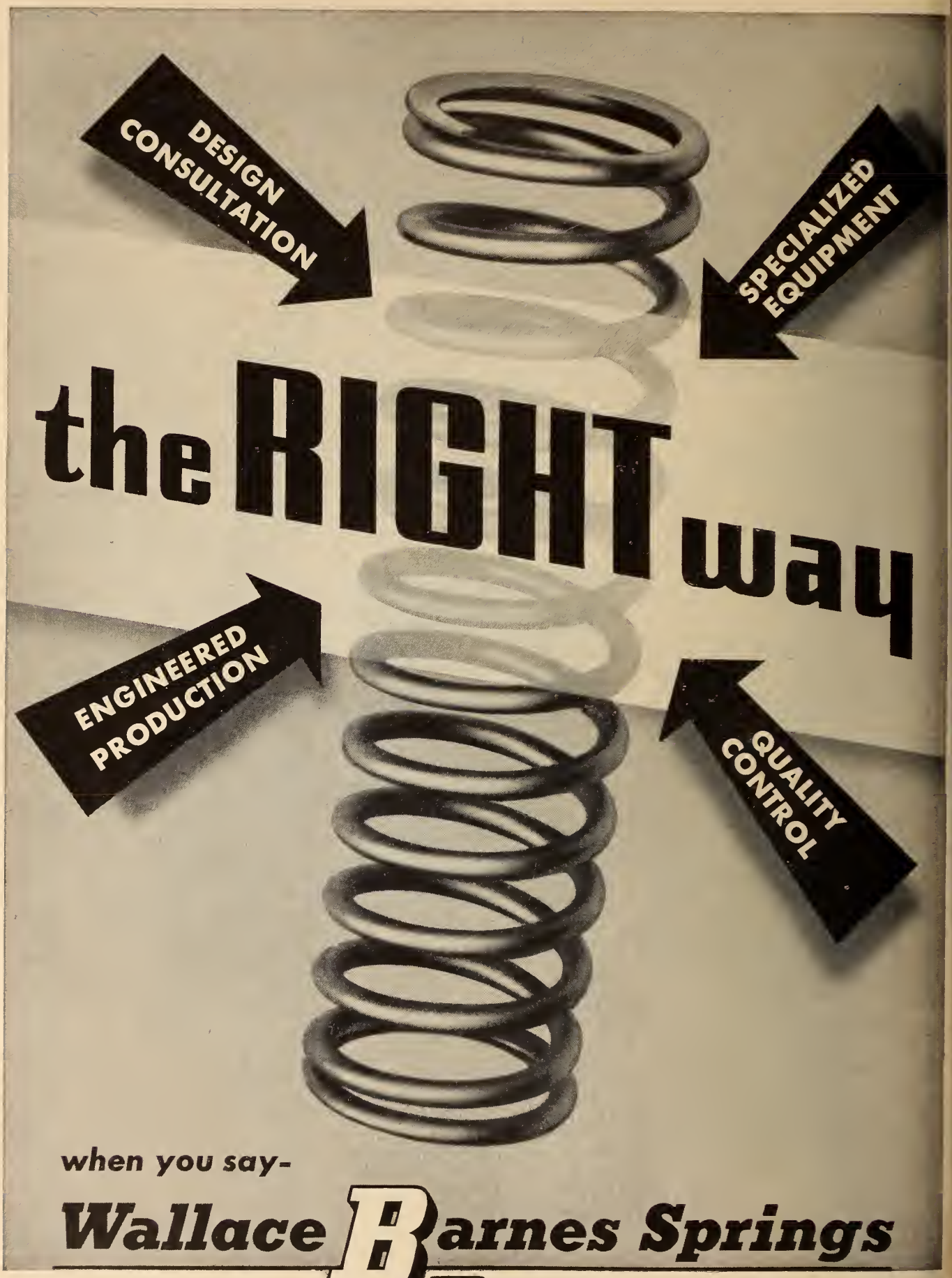
Mr. Linde, who was at the time of his death chief chemist of the North Star Cement Limited, was born in Ventspils, Latvia, in 1895. He graduated as a chemical engineer from the University of Latvia, at Riga, in 1927, and was a member of the National Engineering Society.

As a student he had worked in a portland cement plant in Riga. On graduation he was appointed a chemist and technical advisor to the Department of Customs in Riga. He was for a time, also, teacher of fuel technology and chemistry at the State Nautical School in Riga. In 1940 he worked for the Silicate-Trust, Riga; and he became chief engineer of the portland cement plant at Broceni, Latvia, in 1941. From 1944 to 1951 he was in similar work in Germany, after which he came to Canada. For a time he was with the Department of Economic Development of the Government of Newfoundland, as assistant engineer in charge of the cement plant at Corner Brook. Early in 1952 he went to the North Star Cement Ltd., as chief engineer. He joined the Institute as a Member in 1952.

Lieut. Michael Milovick, R.C.N., JR.E.I.C., was killed in an aircraft accident near Halifax, N.S., in June, 1952.

He graduated from Queen's University in electrical engineering in 1949, joining the Royal Canadian Navy the same year, and being stationed at Halifax. He was later in England and returned to Dartmouth, N.S., in 1950, as a lieutenant (electrical), at the Dartmouth R.C.N. Air Station.

He was born in Czechoslovakia, in 1924, and studied in Toronto, Ontario, before attending Queen's University. He joined the Institute as a Student in 1949, transferring to Junior in 1951.



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Employment Service

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

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

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

Situations Vacant

CHEMICAL

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

CIVIL

CIVIL ENGINEER required by large transportation company in Montreal for duties in bridge department. Apply to File No. 4411-V.

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

CIVIL ENGINEER to act as sales engineer for well established Canadian company. Applicant must be bilingual. Products include reinforcing mesh along with metal-built products. Customers include architects, engineers and contractors. Apply to File No. 4433-V.

ELECTRICAL

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

ELECTRICAL ENGINEER required for the design and layout of specialized equipment in a pulp and paper mill. Applicant should have majored in power preferably test course graduate. Desirable exeprience in test course or short design experience with an electrical manufacturer or period of service as an electrician in an industrial plant or work as a designer in a consultant's office. Salary $325-$350 per month. Apply to File No. 4419-V.

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

MECHANICAL

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

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

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

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

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

INDUSTRIAL ENGINEER preferably mechanical with 3 or more years of industrial engineering experience in industry. Age range 25-35. The duties will be to make engineering studies of manufacturing operations with the purpose of improving operating methods, equipment materials handling, plant layout, and other aspects of factory operation. He will also learn to make time studies to establish production standards for wage incentive installation. The starting salary range is $4000. to $4500. There are good opportunities for advancement. Apply to File No. 4424-V.

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

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

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

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

MECHANICAL ENGINEER for plant located in Southern Ontario. Candidates should be recent graduates with preferably some manufacturing experience and knowledge of rubber. Initiative and mature judgment are, of course, requisites. Duties would include co-ordination and supervision of engineering details in connection with an expanding programme. Apply to File No. 4432-V.

MISCELLANEOUS

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

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

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

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

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

APPLICATIONS WILL BE received up to December 30th, 1952, for the position of assistant city engineer of the icty of Port Arthur. Applicants must be capable of taking over the departments as and when required. State qualifications, experience, etc., in application. Apply to File No. 4425-V.

ASSISTANT TO COMMISSIONER of works and buildings reqiured by Western School District. General duties will include assessment of buildings to determine repairs, supervision of the repair programme, and responsibility for caretaking and maintenance of schools, all under the direction of the commissioner of works and buildings. Applicants should have preferably training and experience in the maintenance of buildings, knowledge of mechanical and structural engineering and successful experience in dealing with personnel. Salary range $5250.-$6250. Letters of application should give full details of education, training, age and include references. Apply to File No. 4428-V.

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

DESIGN ENGINEERS required by consulting ergineer located in Maritimes for large development programme. Applicants should have experienec in roads, highways, ground services and water filtration plant, etc. Apply to File No. 4431-V.

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

COMPETENT ENGINEERING DRAFTSMEN are required for a newly formed plant engineering group in a large pulp and paper mill in Newfoundland. Excellent opportunity for acquiring all-round engineering experience with good salary under good conditions. Single men preferred. Please submit detail of training and experience, with recent photograph preparatory to an interview during the last week in January, 1953. Employment to start February 1, 1953, or as soon thereafter as possible. Apply to File No. 4435-V.

WANTED
ASSISTANT TO COMMISSIONER OF WORKS AND BUILDINGS

The School District of Winnipeg requires an Assistant to the Commissioner of Works and Buildings whose general duties will include assessment of buildings to determine repairs, supervision of the repair program, and responsibility for caretaking and maintenance of schools, all under the direction of the Commissioner of Works and Buildings.

In evaluating applications, consideration will be given to training and experience in the maintenance of buildings, knowledge of mechanical and structural engineering, and successful experience in dealing with personnel. Salary range $5250-$6250 per annum.

Letters of application giving full details of education and training, experience, age, and including references, should be forwarded before December 15, 1952, to Mr. F. A. Allden, Secretary-Treasurer, School District of Winnipeg, cor. William and Ellen Streets, Winnipeg, Manitoba.

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

CHEMICAL

YOUNG CHEMICAL ENGINEER to locate on research staff and to man new research laboratory now in process of building. The position will entail plant process and new process research in nickel refining and related work. Location Ontario. Apply to File No. 4359-V.

JUNIOR OR INTERMEDIATE chemical engineer required to fill vacancy in the control department of a pulp and paper mill located in The Maritimes. Apply to File No. 4362-V.

CHEMICAL ENGINEER OR equivalent required by manufacturer of water treatment and conditioning equipment. Applicant will be trained in phases of work with which he is not familiar. General duties: laboratory analysis, instrument calibration, field testing and correction, study analysis, occasional sales and interview of prospects, etc., age range 25 to 35 years. Apply to File No. 4365-V.

CHEMICAL ENGINEER to act as sales engineer for organization in Montreal. Prefer a man, under 35 years of age, with industrial selling experience, particularly in the metal finishing field. Salary is open. Apply to File No. 4368-V.

CHEMICAL SALES representative (Sherbrooke and Quebec area) the work consists of handling all phases of industrial sales, including actual sales contracts, technical service, correspondence. Large oil company located in Montreal. Apply to File No. 4369-V.

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

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

CIVIL

CIVIL ENGINEER graduate from recognized university to fill post of Deputy Director of Public Works, Bermuda. Applicant should have experience in road building and surfacing, general building construction, including reinforced concrete, steel and timber, and be capable of structural design. Experience in handling men, and in executive control is essential. Age 35 to 40. Apply to File No. 4354-V.

YOUNG GRADUATE CIVIL engineer for position of transitman on a railway division in Province of Quebec. Commencement salary $275.00 a month increases according to service and experience. Apply to File No. 4366-V.

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

CIVIL ENGINEER TO work as town engineer in Province of Quebec. Must be bilingual with good knowledge of sewage, waterworks, roads, etc. Salary range $5,000.00 per year. Apply to File No. 4383-V.

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

Applications will be received up to 30th December, 1952, for the position of Assistant City Engineer of the City of Port Arthur. Aplicants must be capable of taking over the department as and when required.

State qualifications, experience, etc., in application. Arthur H. Evans, City Clerk.

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

THE CANADIAN INSTITUTE OF STEEL construction is requesting applications for a bilingual civil engineer with a minimum of ten years experiencs for the position of Eastern representative of their body, with headquarters in Montreal. Applicants should state particulars of education and practical background. The selected engineer must be prepared to travel in Eastern Canada covering all of the Maritime Provinces, Newfoundland and Quebec. Applications will be treated as strictly confidential. Apply to File No. 4412-V.

ELECTRICAL

ELECTRONICS ENGINEERS 3 to 10 years experience in design and development of radio and T.V. telecommunications for commercial and defence projects. Location Ontario. Apply to File No. 4356-V.

ELECTRICAL ENGINEERS EXPERIENCED on small transformers for reseearch and development department. Location Ontario. Apply to File No 4356-V.

ELECTRICAL ENGINEER required for municipally operated electric utility in Prairie City. Preferably with 1 or 2 years experience. Duties consist of design of 13,200 and 2,300 volt feeder lines, pole layouts, cost studies. Some supervision of construction. Hospitalization, and medical and pension schemes, excellent working conditions. Please state age, qualifications and salary expected. Apply to File No. 4367-V.

ELECTRONIC ENGINEER to manage photo development plant located in Province of Quebec. Applicant should have knowledge of chemistry and be bilingual. Advancement offered. Apply to File No. 4383-V.

GRADUATE ELECTRICAL ENGINEER with two or three years experience in product design. He should preferably be familiar with the content of J.A.N. specifications to enable him to work as a member of an electronic components standardization group. In addition he should be capable of exercising supervision over two or three electrical layout draughtsmen and have a good working knowledge of high frequency

Civil Service
(Federal)
Draftsmen

GRADE 1 — $2500-$2920

GRADE 2 — $2920-$3480

GRADE 3 — $3480-$4180

for Government departments at Ottawa and various centres.

Details and application forms at your nearest Civil Service Commission Office, National Employment Office and Post Office.

networks and pulse circuiting. He should be willing to locate in Ottawa. Salary will be commensurate with qualifications. Apply to File No. 4384-V.

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

MECHANICAL

MECHANICAL ENGINEERS with 3 to 10 years experience in manufacturing, tooling and design for manufacturing for work on defence projects and home appliances. Location Ontario. Apply to File No. 4356-V.

NATIONALLY KNOWN LOCK and builders hardware firm is looking for a young mechanical engineer who is interested in industrial engineering. He will be placed in the time study and methods department in preparation for further advancement in the firm's engineering department. Applicants should be interested in tool and product design. Age, experience, marital status and salary expected should accompany letters of application. Apply to File No. 4376-V.

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

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

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

MECHANICAL ENGINEER required for expansion programme by manufacturer, located in Ontario, of automotive bearings, bushings, and other precision products for the automotive and allied industries. Age 30 to 35 years. Apply to File No. 4391-V.

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

GRADUATE ENGINEER preferably mechanical engineering, with 5 years or more of industrial engineering experience age range 27-35 years. The duties will be to activate studies of retailing outlets of large organization, with the purpose of improving layouts of future stores and material handling, in order to obtain most effective and economical operation. Salary range is $6,000.00. Opportunities excellent for imaginative person. Apply to File No. 4375-V.

MINING

MINING ENGINEER required primarily for survey and lay-out work with anywhere from 2 to 5 years experience. Location Province of Quebec. Apply to File No. 4361-V.

MINING ENGINEER with some experience underground for position of safety engineer under supervision of safety director. Location Province of Quebec. Apply to File No. 4361-V.

MISCELLANEOUS

ENGINEER REQUIRED by manufacturer in Ontario. Applicant should be recent graduate interested in following employment in illumination. Apply to File No. 4306-V.

AN ENGINEER required by Western Municipality with varied programme of expansion, for position of office engineer. Applicant must have had general design experience on various types of structures and preparation of estimates and specifications. He will be required to direct a small staff of draughtsmen and compile plans of proposed works. Permanent position for one with necessary qualifications. Please give full particulars of age, education, experience, when available and salary desired. Apply to File No. 4352-V.

SALES ENGINEERS for Toronto and Montreal, manufacturer located in Toronto of various power equipment. Apply to File No. 4358-V.

ENGINEER REQUIRED as assistant to plant engineer and for various production problems eventually leading to supervisory position for the right man. Located in the Maritimes. Apply to File No. 4360-V.

MECHANICAL OR MINING ENGINEER with some experience in ventilation work. Applicant should be definitely interested in following ventilation work. Position open is that of assistant to senior ventilation engineer. Staff accommodation available for single man. Location Province of Quebec. Apply to File No. 4361-V.

FULL INFORMATION is available for a large number of vacancies that exist for engineers in all fields of the profession to work for the Canadian Government under the Columbo Plan. Locations South and East Asia. Apply to File No. 4372-V.

PETROLEUM ENGINEER and petroleum geologist required by Public Service Commission in Western Canada. Duties, to perform field and research work on gas and oil reserves. Geologist to perform laboratory work on studies of the stratigraphy of the sedimentry area of the province. University grad. in related field such as geological, petroleum chemical or mechanical engineering, but as a geologist for the petroleum geologist position and preferably supplemented by related experience. Apply to File No. 4374-V.

TOWN MANAGER required in Province of Quebec. Applicant must be bilingual with good knowledge of sewage, waterworks, roads plus administrative ability. Salary range $6,000.00 to $7,000.00 per year. Apply to File No. 4383-V.

REPRESENTATIVE REQUIRED by the Technical Information Service of the National Research Council to act in a liaison capacity with industry in the Toronto area. Applicants must have a degree in some field of applied science and appropriate experience would be advantageous. Apply to File No. 4387-V.

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

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

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

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

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

MECHANICAL, ELECTRICAL & ELECTRONICS ENGINERS, Mechanical and Electrical draughtsmen, preferably with aircraft or aircraft equipment experience, required by leading airline to work in Montreal and/or Winnipeg. Salary dependent upon qualifications and experience. Apply to File No. 4402-V.

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

MECHANICAL OR CIVIL ENGINEER required by well known manufacturer of heavy mechanical equipment to supervise installations in Montreal and eventually work across Canada. Apply to File No. 4406-V.

Situations Wanted

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

Chief Engineer

Engineer with proven record of extensive experience in structural design required by well established organization located in highly regarded, large, community about one hundred miles from Montreal.

Responsibilities will include supervision of draughting departments.

Good salary offered to right man for this attractive position.

GRADUATE ENGINEER, 10 years experience, married, desires position with initiative and responsibility in plant engineering or similar work. Experience consists mainly of plant engineering in design and maintenance with a large company having a wide variety of equipment. Work included administrative, mechanical, electrical, instrumentation and various types of piping. Apply to File No. 548-W.

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

MECHANICAL ENGINEER, B.Sc. (M.E.), M.E.I.C., P.Eng. (Ont.), 14 years varied engineering experience in design, production and administration. Desires position with scope for advancement in overall management responsibilities. Apply to File No. 2745-W.

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

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

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

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

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

MECHANICAL ENGINEER, Jr.E.I.C., P.Eng., interested in design or development work in I.C. engine, automotive or similar field or in instrumentation and control. Available on one month notice to present employer. Apply to File No. 3460-W.

ELECTRICAL ENGINEER, S.E.I.C., University of Manitoba 1951, age 32, and a veteran of World War II. Experience as hydro plant operator and plant engineer, also some experience in electrical draughting, design and installations. Desire job pertaining to the field of electrical design and draughting. Would also consider good maintenance position. Western Canada location preferred. Apply to File No. 3652-W.

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

ELECTRICAL ENGINEER, Jr.E.I.C., 1948 graduate, married. Desires sales position in Montreal. Experience includes two years student engineering course with Can. Westinghouse Co. Three years with public utility on line design and construction, hydro-electric power generation and transmission, short circuit system studies, system relay planning. Apply to File No. 3841-W.

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

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

MECHANICAL ENGINEER, 1951 graduate, S.E.I.C., P.Eng., single, age 26, desires employment in Ontario or the Prairie Provinces in the field of design, maintenance and construction (plant engineering) or industrial engineering. Experience includes industrial engineering, cost estimating, time and motion study, planning floor layouts for machine product shops, machine loading, steam power plant operation, drafting and experience in the maintenance and repair of modern farm machinery. Apply to File No. 3913-W.

GRADUATED MECHANICAL & ELECTRICAL ENGINEER Jr.E.I.C., Austrian immigrant, one year in Canada, fluent in English and French, seeks maintenance or plant engineering position in textile, paper or chemical industry. 3½ years experience as project engineer and field work supervisor in planning, maintaining and erecting of heating and air conditioning plants, piping and thermo electric power stations. Apply to File No. 3945-W.

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

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

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

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

MECHANICAL ENGINEER, S.E.I.C., 1951 graduate, age 31, married, bilingual, veteran, 5½ years technical branch R.C.A.F., past experience includes production, supervision, design, layout and construction. Desires position with engineering firm or in engineering department of industrial firm. Interested in design, planning, estimating and layout work in either generalized or specialized field. Apply to File No. 4025-W.

MECHANICAL ENGINEER

For old established growing concern in S.E. Ontario within 70 miles of Toronto. Applicants must be interested in design work as applied to Materials Handling. Permanent situation for keen young man prepared to make himself thoroughly familiar with the business and accept responsibility. Group insurance, profit sharing and pension plan available. Apply stating experience, education and remuneration expected to File No. 4418-V.

1952 GRADUATE IN civil engineering, desires employment in soil mechanics and foundation field. Willing to accept employment in laboratory. Quebec Province preference as location. Apply to File No. 4029-W.

MECHANICAL ENGINEER S.E.I.C., 1952 McGill graduate desires position with a stable Canadian firm. Experience includes maintenance contruction, direction and research. Apply to File No. 4033-W.

MECHANICAL ENGINEER, Mem. A.S.M.E., B.Sc., A.M.I.Mech.E., A.M.I.E.E., considerable experience senior technical and administrative positions at board levels, general mechanical engineering background with specialist knowledge uses and distribution of oxygen and industrial gases, also liquid petroleum gases, including American codes of practice, flair for getting results, especially on new projects, 38, British but Canadian immigrant. Seeks interesting position any capacity anywhere in petroleum, industrial gas industry or any general engineering giving scope to drive, initiative and leadership. Apply to File No. 4034-W.

SAFETY ENGINEER, B.Sc., M.E.I.C., P.Eng., 13 years of varied engineering and design experience, 4 years specialized work in accident prevention and fire protection. Familiar with modern methods and capable of preparing and installing an up-to-date accident prevention programme. Apply to File No. 4035-W.

FIELD ENGINEER, M.I.T. civil engineer and Harvard business school graduate desires field engineering position with closely held contractor in which management and ownership participation is eventual possibility. Experience as World War II U.S. engineer officer, and as office engineer, personnel manager, and assistant to president of a large contractor. 28, married. Apply to File No. 4036-W.

CIVIL ENGINEER, Jr.E.I.C., P.Eng., B.Sc. (Queen's 1948), desires employment in personnel, costing or planning work of any type. Four years experience in charge of municipal and public utilities work in a 5,000 population Ontario town including construction, maintenance and quite extensive administration. Available anywhere in Canada upon one month's notice. Apply to File No. 4037-W.

CHEMICAL ENGINEER, Jr.E.I.C., B.Eng., 1949, B.Sc. 1947, scholarship student 1944-1949, age 25, single. Experience includes one year lecturer in chemistry at an Eastern University, two years in industrial development laboratory. Prefers job in chemical industry, anywhere in Canada. Available on approximately

one month's notice. Apply to File No. 4038-W.

ELECTRICAL ENGINEER, M.E.I.C., B.A.Sc. 1946. Married, age 34. Three years experience administration R.C.C.S., two years own business, experienced in power distribution, four years sales engineering in electrical hardware field including product improvement and design, sales, estimating, contact with most public utility men in Ontario. Eager to prove administrative ability in progressive manufacturing company. Prefer location Southern Ontario but will consider any location. Apply to File No. 4039-W.

GEOLOGIST AND MINING ENGINEER, P.Eng., B.A.Sc., M.Sc., Ph.D. Age 34, married, three children. Presently employed. Thirteen years experience in mining and geology; underground mining in Northern Ontario and Quebec during three summer seasons, geological surveying in Quebec and Ontario, prospecting for mining companies, geophysical field and office work, teaching. Desires permanent responsible position with well established firm. Apply to File No. 4040-W.

CIVIL ENGINEER and chartered structural engineer (arriving in Ontario 12 Nov.) specializing in design of reinforced concrete, light industrial and framed structures, seeks responsible position. Age 34, B.Sc. Eng., B.Sc. (maths and chemistry), A.M.I. Struct. E., taking final examination for A.M.I.C.E. in October. Experience comprises 3 years as reinforced concrete designer and checker with consulting engineers in London on industrial and commercial structures including liaison with architects. 7½ years miscellaneous construction experience, knowledge of modern methods of structural analysis, soil mechanicse, current American design practice and J.C. and A.C.I. codes. Apply to File No. 4041-W.

MECHANICAL ENGINEER M.E.I.C., age 35, 12 years experience in lay-out and design of air conditioning, ventilating heating, cooling, materials handling, machine design and draughting. Had own consulting firm and successfully developed inventions in Sweden. Presently employed with a consulting firm as a designer for air conditioning, ventilating, cooling, etc. Desires a position with responsibility where initiative will lead to advancement. Speak perfect English. Moderate starting salary and no location preference. Apply to File No. 4047-W.

MECHANICAL ENGINEER Jr.E.I.C., age 31, married, 2 children, ex-senior officer R.C.A.F., desires position as plant engineer or assistant in the mining or pulp and paper field. Experience includes 6 years in construction, plant layout, maintenance and supervision chiefly in the mining field. Apply to File No. 4048-W.

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

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

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

ELECTRICAL ENGINEER, Jr.E.I.C., (Man.) 1951, age 32, married, one child. Foreman journeyman electrician on large building construction. Electrical superintendent, large water power project. Well experienced in design of wiring for industrial and office building. Three years of radar officer R.C.A.F. Desire responsible position with contractor or consulting engineers. Apply to File No. 4055-W.

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

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

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

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

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

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

STATISTICAL ENGINEER, university graduate, specialist in mathematical statistics, familiar with sequential analysis (new technique reducing the number of observations required) seeks a job in this capacity. Apply to File No. 4065-W.

ELECTRICAL ENGINEER, B.Eng., Power COURSE, McGill '41, M.E.I.C., P.Eng., Que. Age 33. Bilingual, married. Eleven years experience maintenance, operation, construction and administration hydro-electric generation, transmission and H.V. distribution. Desires position at management level with utility or manufacturer offering opportunity for advancement. Eastern Canada location preferred but not governing. Apply to File No. 4066-W.

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

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

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

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

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

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

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

MECHANICAL ENGINEER, B.Sc. (M.E.), Jr.E.I.C., P.Eng., 28 years old, two years experience in oil piping, site drainage and plumbing design, also two years general machine shop experience seeks

DESIGN ENGINEERS AND FIELD ENGINEERS

Wanted by a firm of engineers and builders specializing in prestressed and precast concrete throughout Canada.

Several years experience in reinforced concrete is required. Position offers salary, participation in company's hospitalization and pension plans and eventual bonus.

Applicants should give full details including age, education, experience, marital status, salary requirements. Personal interview will be arranged with selected applicants. Apply to File No. 4436-V.

employment in Western Canada in any of the above fields which offer a good opportunity for advancement. Presently employed in Ontario but must move west for reasons of wife's health. Apply to File No. 4081-W.

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

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

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

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

CIVIL ENGINEER, S.E.I.C., Manitoba 1952, age 31, 2 children; 6 months in maintenance dept., 5 months as instrumentman, 4 years radar mechanic in R.C.A.F., 18 months training as machinist apprentice. Would like job in design office or with any concern where out of town travel is at a minimum. Any phase of engineering including manufacturing and service work where hard work and competence are rewarded. Apply to File No. 4086-W.

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

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

Attention, Members

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

This will result in a better service to everyone concerned

TELEPHONE PLATEAU 5078

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

News of the Branches

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

Cornwall

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

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

October Meeting

Dr. J. A. Retty, assistant to the president of Fenimore Iron Mines Limited, spoke on the Quebec-Labrador Iron Ore Development, at a Branch meeting on October 14, 1952. Dr. Retty is one of the pioneers in the search for iron ore deposits in Quebec and Labrador, and is at present carrying out geological surveys for his company near Ungava Bay in Canada's northland.

Dr. Retty briefly reviewed the history of the present discoveries. The first iron ore deposits in the Quebec Labrador region were discovered in 1929 but the chief discoveries were made by his geological parties in 1943 after seven years of intensive search in the great iron ore formations located 50 years earlier by Dr. A. P. Law. Only a small portion of the area has been explored, and Dr. Retty predicted that the reserve deposits are much greater than present discoveries indicate.

Nature has provided more than iron ore in this region. There are several sites where water power can be developed, with a total potential of 1,750,000 horsepower. To develop these natural resources it was necessary to use capital from the United States as only the United States interests have both the capital and the required ore market.

There are two main reasons for developing the Northern Quebec and Labrador deposits instead of the large South American deposits. Firstly, the overland St. Lawrence River-Great Lakes transportation route for Canadian ore is easier to protect in wartime. Secondly, because Canada has a reputation for stable government, private interests feel safe investing money in this country. Dr. Retty classed the development of these iron ore deposits and the development of the St. Lawrence Seaway project as the two most important strategic projects to be undertaken for the defence of Canada.

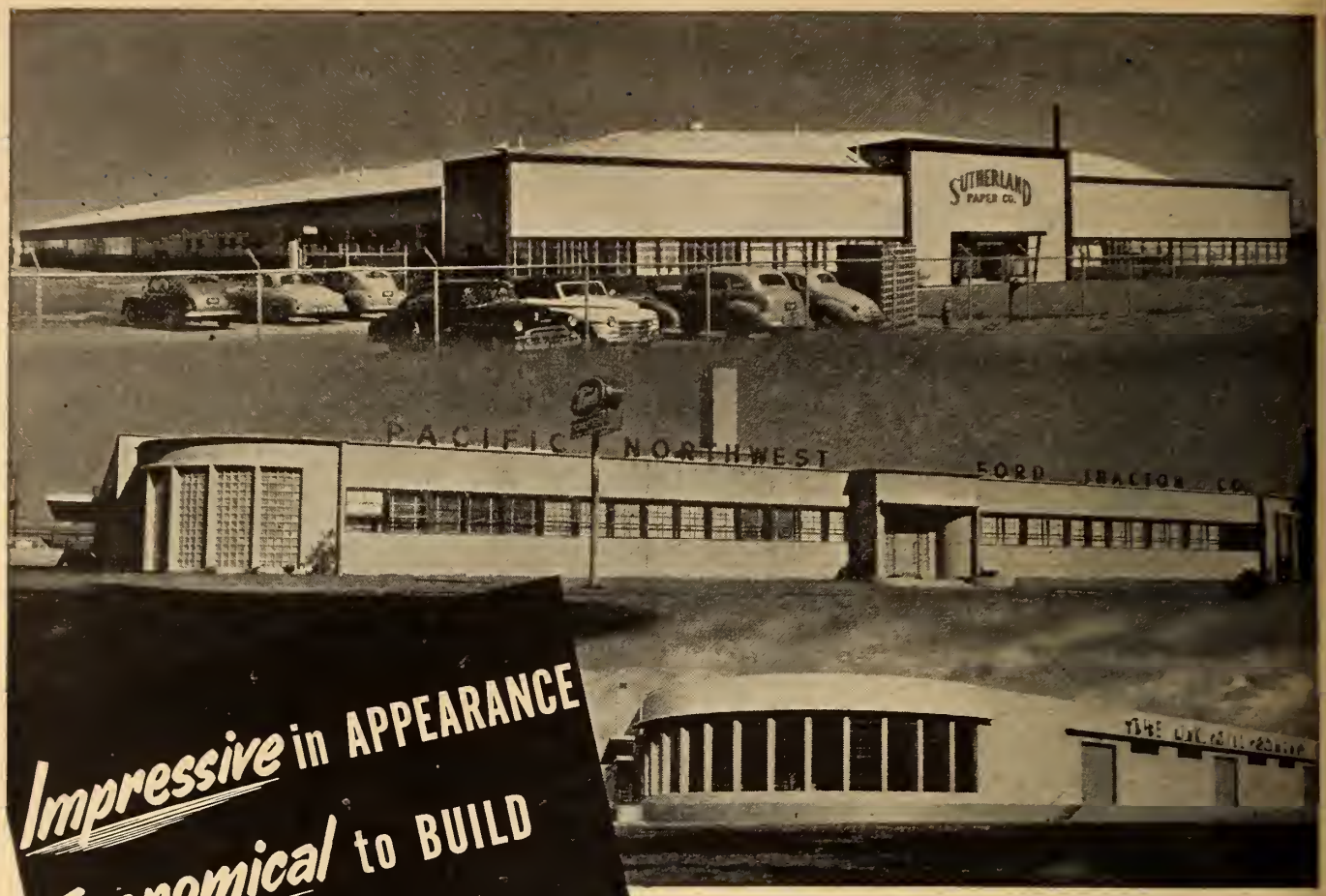
The development in Quebec was entirely airborne, the company having 13 aircraft transporting 33,000,000 pounds of freight a year by air. A railway is now under construction from Seven Islands to Knob Lake, about 360 miles inland.

Dr. Retty reviewed the geological history of the area of precambrian rocks and the extent of the trough through Northern Quebec in which further large iron ore deposits might be discovered.

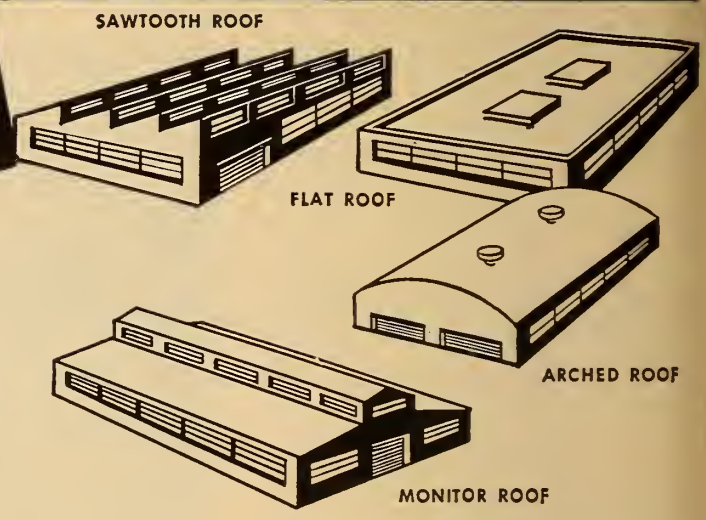
Dr. Retty was introduced by Jack Morris and thanked by H. W. Nickerson. Branch Chairman B. T. Yates, presided at the meeting.

(Right.) This group, photographed during the festivities, includes, left to right, Drummond Giles, President Stirling, H. Malcolm, Mrs. Malcolm, Mrs. P. Nasmyth, C. Maye, P. Nasmyth, J. Morris, Mrs. Giles, Mrs. Morris.

(Below.) Head table at a recent Cornwall Branch dinner meeting, attended by President J. B. Stirling and Mrs. Stirling. Left to right, Mrs. L. Snelgrove, D. Ross-Ross, Mrs. B. T. Yates, J. Morris, Mrs. Drummond Giles, Dr. Stirling, Branch Chairman B. T. Yates, Mrs. Stirling, Drummond Giles, Mrs. J. Morris, and R. Terry.



Impressive in APPEARANCE
Economical to BUILD
Profitable to USE...



These buildings are typical of contemporary industrial design which combines excellent appearance, functional use, and economical construction. They demonstrate how structural units of Timber Structures, Ltd. provide fire-safe, low maintenance construction, built for several generations of trouble-free use.

Reasonable costs apply to both the structural units themselves, and to the time saving, functional construction which they make possible.

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An illustrated booklet, "Industrial Buildings", contains pertinent facts about these modern structural units. Your nearest Timber Structures office has a copy for you; or fill in and mail the coupon, and a copy will be sent to you at once.

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Eastern Townships

R. H. Blackmore, Jr.E.I.C., *Secretary-Treasurer*
Gaston Masse, M.E.I.C., *Branch News Editor*

Professional Development Course

A meeting was held at the Club Social, Sherbrooke, on October 17, 1952, to discuss the setting up of a professional development course for the Eastern Townships Branch. The Committee was very fortunate to have as guest and advisor Col. L. F. Grant, chairman of the E.C.P.D., and field-secretary of the Institute. Mr. E. Powers agreed to act as registrar and plans were made to begin courses on November 14th. It was decided that fifteen meetings would be held, on all Friday evenings, except those on which regular branch meetings were scheduled. Fees were set at $6.00 for the complete course.

Subsequent to this meeting, the Branch secured the facilities of the Ecole Technique of Sherbrooke.

The response has been good, and it is anticipated that approximately 30 registrants will be accommodated.

Construction Site Visited, November 8.

Members of the Branch were guests of the construction group at the local baseball stadium which is now being erected at the Baseball Park in Sherbrooke.

The engineers met at four o'clock and were taken in groups through the structure under the guidance of the engineers and construction supervisors.

Mr. Gaetan Cote of Cote, Lemieux, Carignan and Bourque, consulting engineers, organized the itinerary with the assistance of J. Demarque, R. W. Doull and Rene Martineau, construction superintendent.

The Baseball Stadium is unique in its construction being one of the first structures in Canada to use pre-stressed concrete for linear building assembly. This new means of construction was developed on the European continent some years ago, and is now widely used there and also in Great Britain. Its introduction into the United States and Canada, however, is relatively recent, and the local group of construction personnel are to be congratulated on the advanced development which this enterprise signifies.

Contractors for the new stadium are the Preload Company of Canada, Limited, and Mr. Stan. Grondin of Sherbrooke. The consulting engineers are Messrs. Cote, Lemieux, Carignan and Bourque, while the architectural duties are being handled by Audet, Tremblay and Audet.

Following the examination of the structure, a series of interesting load tests were demonstrated, proving the ability of the material to withstand the loads expected.

The group then proceeded to the Club Social to hear a panel discussion on pre-stressed concrete.

Mr. G. M. Dick, president of the Branch, occupied the chair. Mr. R. W. Doull, chief engineer of the Preload Company of Canada gave a short talk on the history and development of pre-stressed concrete, while Messrs. Gaetan Cote and J. Demarque answered the various questions which were submitted by several of the engineers in the audience.

The very interesting session concluded with a buffet supper tendered by the contractors, the Preload Company of Canada, Limited and Mr. Stanislas Grondin of Sherbrooke. Alderman Everett Nicol represented His Worship the Mayor, while Mr. A. Deslauriers, city clerk, was also present.

Invitations had also been extended to the local architects, and a good representation of this profession was also present. Mr. J. Paul Audet who is architect for the firm Audet, Tremblay and Audet, represented his firm.

At the close of the meeting, the chairman mentioned that the Junior Engineers' Lecture Course would hold its first session on Friday evening, November 14th. The first session, presented by Professor Gray of Bishop's University, would deal with public speaking. All members wishing to enroll for the lecture course were asked to contact Mr. E. Powers.

Edmonton

John L. Pulford, Jr.E.I.C., *Secretary-Treasurer*

Dinner Meeting October 7

At the first formal dinner meeting of the season at the Macdonald Hotel on October 7, 1952, Mr. N. J. Allison, vice-chairman presided. Sixty-two members and guests were present for the dinner meeting and 75 members were present for the speech of the evening. Chairmanships of the various committees was announced as follows: Entertainment, N. J. Allison, chairman and H. L. Roblin, member; Membership Committee, C. A. Davidson, chairman; Young Engineers Committee, Keith Cummings; Engineers' Wives Committee, C. Z. Monaghan; Community Planning Committee, L. E. Gads; Publicity, Roy Nurse; Nominating Committee, E. L. Smith; and Civil Defence Committee, T. C. Main.

The visits of President Stirling and Dr. L. Austin Wright in Edmonton, December 3 to December 6, was announced and the date of the Annual Ball at the Corona Hotel was set as December 4th with limited tickets available for a combined dinner and dance. In addition announcement was made of the Regional Council Meeting to be held in Edmonton on Saturday, December 6th.

Phases of the Young Engineers Training Program were briefly outlined including the possibility of incorporating some public speaking course into this program. Many members present signified their interest in such a topic.

Mr. Jack Ford, chief engineer of the Canadian Utilities Limited, introduced by Roy Nurse, delivered an excellent paper dealing with power development in the Province of Alberta. Mr. Ford told of the development of Alberta power to the present day and provided the Branch members with a look into the future as far as Alberta is concerned. Mr. Ford compared expansion from thermal generation methods with expansion by means of water power hydro development, and indicated work already being undertaken along each of these lines.

At the conclusion of Mr. Ford's well prepared speech, with its many humorous interjections, C. Z. Monaghan thanked him.

Buffet Supper

A new form of Branch meeting was inaugurated on Monday, October 27, when the Branch held a light buffet supper at the Kingsway Branch of the Canadian Legion in Edmonton. Seventy-six members and guests were present.

B. F. Willson, Branch chairman was in charge of the meeting which was

addressed by Professor Wardlow Porteous, professor of electrical engineering at the University of Alberta. Professor Porteous' very timely talk on Leonardo da Vinci, was entitled "The Father of Engineering."

After an introduction by Professor L. E. Gads, Professor Porteous who has devoted many years to the study of the life of this very famous man, read an excellent paper dealing with the life of da Vinci. The versatility and brilliance of Leonardo da Vinci were illustrated by well chosen slides and the meeting provided a diversion from the usual technical discussion which was quite pleasing to the audience.

The speaker was thanked by B. F. Willson, who expressed the group's appreciation for a well prepared, well delivered program.

Fredericton

R. E. Tweeddale, M.E.I.C.,
Secretary-Treasurer

R. S. Myles, M.E.I.C.,
Branch News Editor

Field Trip and Dinner Meeting

Members of the Fredericton Branch with their wives and guests motored to Perth on November 16 and held a dinner meeting at Ann's Tea Room. Perth had been chosen to give members of the Branch from the north-western parts of the province a better chance to attend a meeting, and to afford an opportunity of witnessing the demolition of the old Tobique Narrows Bridge. A large number of members were present including groups from Fredericton, Edmundston, Woodstock, and Grand Falls as well as from Perth.

Special guests included Hon. Edgar Fournier, chairman of the N.B. Electric Power Commission; Brigadier T. Eric Snow, O.C. N.B. Area; Walter Powers, M.L.A.; Dr. E. O. Turner, dean of engineering at the University of New Brunswick; L. H. Mahaffey, superintendent for the Power Corporation of Canada on the Tobique Narrows Project; Lt.-Col. S. Slater, Eastern Command engineering officer; Colonel Mitchell, construction engineer for the Power Corporation of Canada; Major George Mackie; Mr. J. L. Feeney; and their wives.

At the Engineers' Ball of the Hamilton Branch, reported in the *Journal*, November issue, certificates were presented by President J. B. Stirling to winners of the students and junior paper competition. Left to right, Dr. Stirling, J. A. Mitchell, F. S. Gue and M. J. McAuliffe.

After the dinner meeting the group motored to the site of the Tobique Narrows power project; and from a vantage point about half a mile distant saw the old Tobique Narrows Bridge go up in a briliant flash and a cloud of smoke. The demolition of the bridge was carried out by members of the 1st Brighton Field Squadron, R.C.E. (Reserve) from Saint John. The group then broke up into small parties, each with a guide supplied by the N.B.E.P.C., and were taken on a tour of the power project which includes the dam, the power house, the new bridge across the dam, and the railway diversion along the Tobique River. The whole afternoon's program was a complete success and the members of the branch were very pleased with arrangements made by the various committees.

The demolition of the highway bridge at Tobique Narrows, N.B., was photographed by the Dept. of National Defence. The site will be in the back-flowage area of the hydro-electric power installation downstream.

Halifax

W. J. Jefferson, M.E.I.C.,
Secretary-Treasurer

J. P. Dumaresq, M.E.I.C.,
Branch News Editor

Dr. D. J. MacNeil Addresses Meeting

Dr. D. J. MacNeil, of University of St. Francis Xavier, spoke on the subject of minerals and world affairs, at a supper meeting of the Halifax Branch, October 23, 1952. Dr. MacNeil is a vice-president of the Engineering Institute.

Minerals have an important bearing on major political actions, in Dr. MacNeil's opinion. In analysing the earth's processes, we encounter immeasurable periods of time. If we considered the earth as a ball 1/5,000,000 of its normal size, it would still be 8¼ feet in diameter. Mt. Everest at that scale would be 1/16 of an inch above sea level and the deepest mine would be 1/24 of an inch. To get a relative scale of time, if we let six seconds represent one year, then the earth would be 500 years old and the present era would have existed for the past fifteen years. Many would have been on the earth for only two weeks.

It is estimated that the minerals of value comprise about one per cent of the earth's crust. Both power and raw materials are obtained from these minerals. Agriculture depends on minerals for fertilizers to make plants grow. When minerals can be dug up and fabricated into articles of trade, people are prosperous. The search for new products is never-ending.

This country produced 1½ billion dollars worth of minerals in 1951. It is the second largest producer of aluminum, the fourth largest producer of copper and lead and it leads in the production of asbestos.

Dr. MacNeil also mentioned the work that is going on in Antigonish where limestone is being mined to produce soda ash. As a salt mine is also available nearby, and a small flow of gas

has been discovered, it is hoped that a soda ash plant may be set up. Dr. MacNeil gave a general description of the method of obtaining soda ash, and further, information on the growth of the petroleum industry in Russia and in the U.S.A.

Hamilton

J. A. Reid, Jr.E.I.C.,
Secretary-Treasurer

F. S. Gue, Jr.E.I.C.,
Branch News Editor

T. S. Johnson Is Speaker

The Hamilton Branch was fortunate in having as its guest, on October 23, Mr. T. S. Johnston, president of the Interprovincial Pipelines Company Limited. Well supported by an excellent film, Mr. Johnston spoke on the economic, financial, and technical aspects of the oil pipeline which is now in operation between Edmonton, Alberta, and Superior, Wisconsin. Among the interesting facts brought out during the talk was the information that Canada's home production of oil, grown to its present volume largely since the Edmonton discoveries in 1947, saves approximately $180 million in U.S. exchange, which compares with Canada's 1951 gold production of $159,000,000.

Mr. Johnston was introduced by Mr. J. R. Hartney, M.E.I.C., and thanked by Mr. H. L. Hillgartner, M.E.I.C.

Kingston

H. D. Forbes, M.E.I.C.,
Secretary-Treasurer

D. R. Graham, Jr.E.I.C.,
Assistant Secretary

November Meeting

The Kingston Branch held its monthly meeting on Tuesday, November 4, at the LaSalle Hotel. The meeting took the form of a buffet supper, with eighty-five members and guests in attendance.

The guest speaker was Professor H. G. Conn, head of the mechanical engineering department of Queen's University, and his subject was, "Warm Air Heating for Small Homes". Professor Conn briefly outlined some of the research work going on at Queen's in this field. He also showed slides of typical warm air and hot water installations, describing the advantages of each type. His talk proved very timely, and an extremely lively question period followed. Professor Conn was thanked by Mr. G. Andrews.

Lethbridge

R. D. Hall, Jr.E.I.C.,
Secretary-Treasurer

Wm. J. Roy, S.E.I.C.,
Branch News Editor

Dinner Meeting, October 25

Fifty-six members, affiliates, and guests were present, and Chairman J. C. Neufeld presided at the first Branch meeting of the season, at the Marquis Hotel.

A brief program of community singing, under the able leadership of R. S. Lawrence, opened the meeting enjoyably.

Mr. Art Hunt highlighted the musical program with two excellent solo numbers. His second selection, "The Lord's Prayer" was dedicated to the memory of the late L. B. "Lee" Watts, city building inspector, who passed away October 20th.

The guest speaker was P. G. McConnell, manager of the Engineering Service

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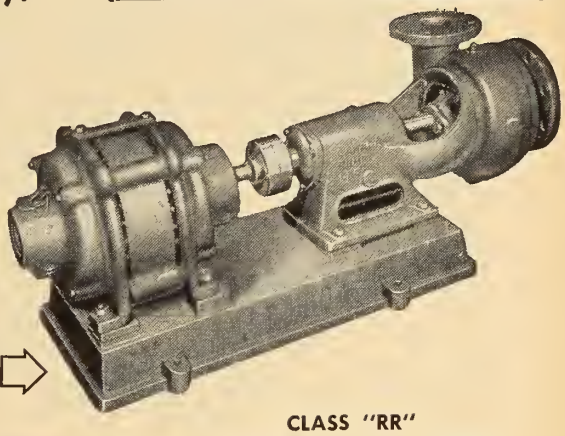

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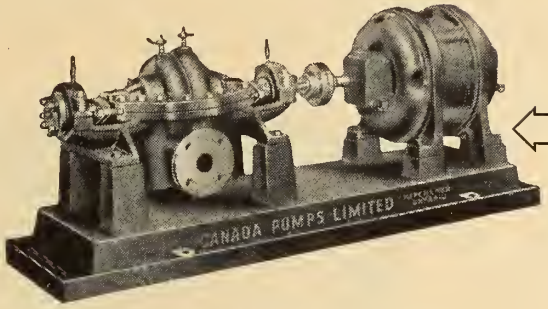

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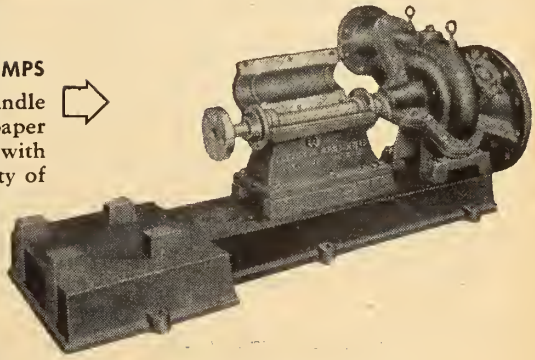

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Division of the Canadian General Electric Co. Ltd., at Calgary. Mr. McConnell gave a most interesting and informative talk, aided by well-prepared diagrams, on "Diesel-Electric Rail Transportation." He commenced with notes on the history of the diesel electric locomotive.

This type of prime mover has a history of only fifty-five years, having been invented in Germany. The following year the first successful diesel-electric rail car was put in service in Sweden. The direct-drive diesel locomotive was proved impractical by a series of experiments carried out in 1912. The first diesel-electric locomotives to operate in Canada were put into service by the Canadian National Railway in 1925. Some of these original machines are still being used by the Pacific Great Eastern Railway. Although the diesel engines have been replaced, the original electrical equipment is still in use.

Mr. McConnell went on to describe the various parts of the locomotive, and the functions of each part. He described the unit as "a power plant on wheels." The diesel engine drives a generator which supplies electricity to the electric traction motors which are geared to the wheels.

Methods were worked out to overcome the undesirable effects of excessive current and voltage. By changing the various circuits of the motors, the drawbar pull can be maintained nearly constant between 10 and 70 m.p.h.

Current limit reduces the drawbar pull below 10 m.p.h., and voltage limit reduces it above 70 m.p.h. The diesel engines are equipped with "turbochargers" which increase their efficiency by approximately 90 per cent. A most interesting feature of these locomotives is dynamic braking on downhill grades. This is accomplished by the motors on the drive wheels acting as generators, and feeding the current they produce into banks of resistors. The current is then dissipated as heat, applying a load to the temporary generators, slowing down the wheels.

Mr. McConnell listed the following advantages of diesel-electric over steam locomotives: availability at a moment's notice, since no firing-up is required; faster acceleration, a great advantage for switcher locomotives; less wear on rails and roadbed since impact forces are absent; higher speeds on curves as a result of the lower centre of gravity; dynamic braking on downgrades; and multiple unit operation with no additional operators.

In addition, the diesel-electric units are more economical to operate, but have an initial cost of nearly twice that of a steam locomotive.

Mr. McConnell concluded his address with the showing of a colour film entitled "Shining Rails", a General Electric production. He was introduced by H. B. Bradley, and thanked by P. E. Kirkpatrick.

Niagara Peninsula

G. W. T. Richardson, Jr.E.I.C.,
Secretary-Treasurer

P. A. Saldat, Jr.E.I.C.,
Branch News Editor

Field Trip, September

On September 25,the Niagara Peninsula Branch members met for an extensive tour of the H.E.P.C. Development—Sir Adam Beck Niagara Generating Station No. 2.

More than one hundred members were present for the tour which was conducted in busses. At the "cofferdams" the members left their busses to get a better view of the intakes to the tunnels. The two intake structures are situated about two miles above the Falls and will each divert 20,000 cubic feet of water a second (7½ million gallons a minute) from the Niagara River. The intake for each tunnel consists of 500-ft.-long gathering tubes, located along the present shore line to take advantage of the main current in the river. The water thus diverted from the Upper Niagara River will be conveyed beneath the city of Niagara Falls by two huge, 5½ mile tunnels. Re-emerging to the surface on the other side of the city, the tunnels will empty into a 2¼ mile canal, which will carry the water to the forebay of the station.

Continuing on, the tour passed by the five access shafts to the tunnels. These shafts are approximately 6225 ft. apart with depths varying from 200 to 330 ft. depending on the tunnels' horizons. The tunnels will have a rough diameter of 51 feet. Complete, they will have circular linings of concrete three feet thick, reducing the diameter to 45 ft.

The next stop was made at the powerhouse site, six miles below the famous cataracts of the Niagara, on the side of the precipitous 300 foot cliff of the lower Niagara River Gorge, and just upstream from the Sir Adam Beck Gen-

Mr. W. Hogg, assistant field project engineer, described the Sir Adam Beck Niagara Generating Station No. 2, to visiting Niagara Branch executive members, on September 25.

Underground, in one of the hydraulic tunnels of Ontario Hydro's Sir Adam Beck power development at Niagara Falls. Here a 2½-yd. electrical shovel equipped with a 3½-cu. yd. bucket loads broken rock into a 15-ton capacity truck. Visiting the site on October 17, were, left to right: Col. H. G. Thompson, assistant general secretary, E.I.C.; Dr. J. B. Stirling, president of the Institute; Gordon Mitchell, the Hydro project manager; Vern Brown, superintendent, Perini-Welsh, contractors; P. A. Pasquet, Niagara Branch chairman; Bill Hogg, assistant field project engineer; Paul E. Buss, councillor of the Branch; and Don Rankin, divisional engineer, Ontario Hydro.

erating Station No. 1. The 931-foot-long, 63-foot-wide and 50-foot-high powerhouse will enclose 12 units with installed capacity of 900,000 kilowatts (1,200,000 horsepower). The site of the generating station enables 295 ft. of the 315 ft. difference in level between the intake and the powerhouse to be utilized for the production of electric power. Thus 50 per cent more power can be produced than if the generating station were built immediately below the Falls, where a head of only 200 ft. could be obtained.

Another feature of the tour was a stop at the modern camp hospital, situated in the administration area. This hospital can accommodate 30 bed patients with floor space for 40 beds in an emergency.

After seeing the trade shops, the storage warehouses and the administration offices, the visitors could well understand the forging progress which has been made by the development staff.

At the conclusion of the tour, the members enjoyed a steak dinner in the large Camp No. 2 Cafeteria. In an after-dinner talk Mr. Wm. Hogg, assistant field project engineer, briefly explained various phases of the project and showed coloured slides taken on the job.

A short meeting was held, bringing to a close a very interesting outing.

October Meeting

The October meeting, a smoker and luncheon, was held at the Hotel General Brock, Niagara Falls, on October 17, 1952, coinciding with the visit of Dr. J. B. Stirling, president of the Institute and Col. H. G. Thompson, assistant general secretary.

Before attending the evening meeting of the Branch, Dr. Stirling and Col. Thompson were conducted on a tour of the Sir Adam Beck Niagara Generating Station No. 2, which is well under construction.

For his evening address to the Branch members, Dr. Stirling spoke on his recent trip to New Orleans where he represented the E.I.C. at the UPADI Conference of Engineering Societies of North America, Central and South America, and gave an account of some of the discussions presented at the meetings. The latter part of the president's address dealt mainly with the recognition of the professional engineer, and "public service" contributed by every engineer. He stated that in many instances he did not agree with the manner in which some of the young engineers look upon the engineering profession. There are some who are mainly concerned with salaries and pension plans, whereas young men should be more interested in training their minds and adjusting themselves to whatever phase of engineering they wish to enter. The president also spoke briefly on the status of professional associations and their place among engineers of to-day, in comparison to the work of the Institute.

Following Dr. Stirling's address, the members were invited to ask the president questions, after which a buffet luncheon was served.

Peterborough

M. V. Powell, M.E.I.C.,
Secretary-Treasurer

J. B. Stirling Visits Peterborough

"The road to success is to forget security and take a chance."

Dr. J. B. Stirling, president of the Engineering Institute, travelling across Canada, has given this advice to stu-

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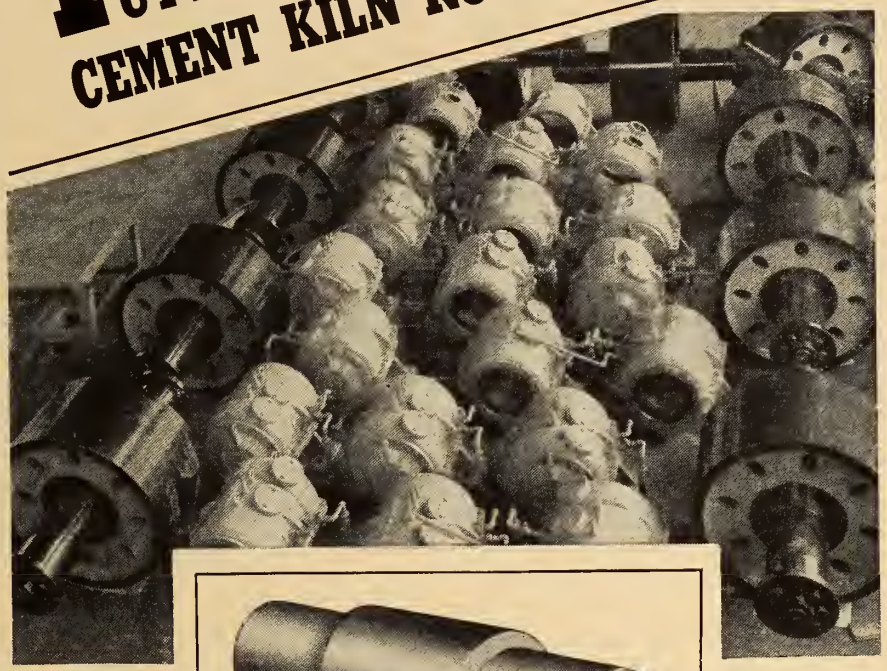

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dents. On October 24 he repeated it to the Peterborough Branch of the Institute.

'I try to tell students that they can't plan their careers for years ahead," said Dr. Stirling.

Dr. Stirling indicated that he wasn't theorizing when he made this statement. He analyzed his own class that graduated from Queen's University 41 years ago.

Fifty per cent of them remained in the professional engineering field. The other 50 per cent had become successes in other walks of life, including real estate, journalism and bus transportation. One had wandered into the women's wear business.

"I'm shocked and amazed at the propaganda I've been reading in technical papers and in the press to the effect that engineers are grossly underpaid; that they are not pulling their weight in public service; and that they are not recognized as an important profession."

He said he wasn't much worried about the low-pay claim. That can be rectified. But he was concerned to see that, according to a recent poll, engineers ranked seventh in prestige among the professions.

Apparently the general public has a higher opinion of medicine, law, university teaching, the ministry, banking and finance.

He urged engineers to take an active part in their community life and not limit their interests to strictly professional work.

"Public service is the engineer's road to recognition," he said.

Ross L. Dobbin, manager of the Peterborough Utilities Commission, is a professional engineer who has been active in community work, Dr. Stirling pointed out. And Mr. Dobbin is known from coast to coast.

Earlier in his address Dr. Stirling told of how Canadian engineers can help their South American colleagues. The engineering standard is not so high in those countries, he said.

"Canadian engineers are among the best representatives we can have in countries like that," said Dr. Stirling. "They are equally as good and sometimes better than our trade commissioners."

Dr. Stirling was accompanied by Col. H. G. Thompson, assistant general secretary. He was introduced by Robert Hailey and thanked by the chairman, D. Alan Drynan.

Saint John

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

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

October Meeting

Members of the Saint John Branch and their wives met at the Admiral Beatty Hotel on October 15. Chairman John Reed presided, and Mr. A. G. Watt opened the meeting with a toast to the ladies.

The members observed a moment's silence in memory of three members who died this summer, Mr. John Mooney, Mr. Barry Wilson and Mr. George Clark.

Mr. A. W. Purdy, sales manager for the Maritime Cement Co., Ltd., of Havelock, N.B., was the guest speaker. Introduced by Mr. Reed, he gave a short history of cement. He described the early cements manufactured in Canada, and continued with a description of the dry process which is used in his company's plant at Havelock.

Due to the great increase in the building industry the demands on the cement industry have increased greatly, with the result that companies have difficulty in making supply meet demand. To illustrate how great the increase has been Mr. Purdy recalled that in 1940, 40 million bags of cement were used in Canada. In 1952 it is expected industry will use 80 million bags, while the use of concrete blocks has increased from 17 million to 63 million blocks since 1945.

Mr. Purdy spoke about air entrained concrete, which is produced by a method whereby minute air bubbles are encased in the concrete through the use of an air entraining agent. This type of concrete has been found to be much more resistant to damage from freezing and thawing.

A colour film prepared by the Portland Cement Association was shown which gave an idea of the processes used in manufacturing cement from the raw product stage to the final stage of bagging and shipping, as well as the various laboratory tests to insure proper quality control.

Mr. John Flood expressed the thanks of the gathering to Mr. Purdy.

Sudbury

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

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

Dinner Meeting, November 10

Dr. John B. Stirling, president of the Institute, was guest at the Sudbury Branch dinner meeting and dance at The Sudbury Granite Club on November 10.

Dr. Stirling was welcomed by Mayor Jessup, and introduced by W. B. McMulen, the city engineer, whom he has known for many years.

Dr. Stirling addressed the meeting on the status of engineering as a profession. He discussed such topics as the benefit to be gained by Canada's co-operating with engineering branches in other parts of the world, the participation of engineers in community affairs, and the advantages of better co-operation between the Professional Engineers Association and the Engineering Institute, in Ontario. Dr. Stirling covered briefly the itinerary for his presidential tour across Canada.

Dr. Stirling advised student and junior engineers to place particular emphasis on a conscientious and genuine interest in the work.

E. R. Eaton thanked the president, who was presented with an ash tray made of copper and other locally processed metals, by W. J. Ripley of the International Nickel Company.

Winnipeg

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

Electrical Section

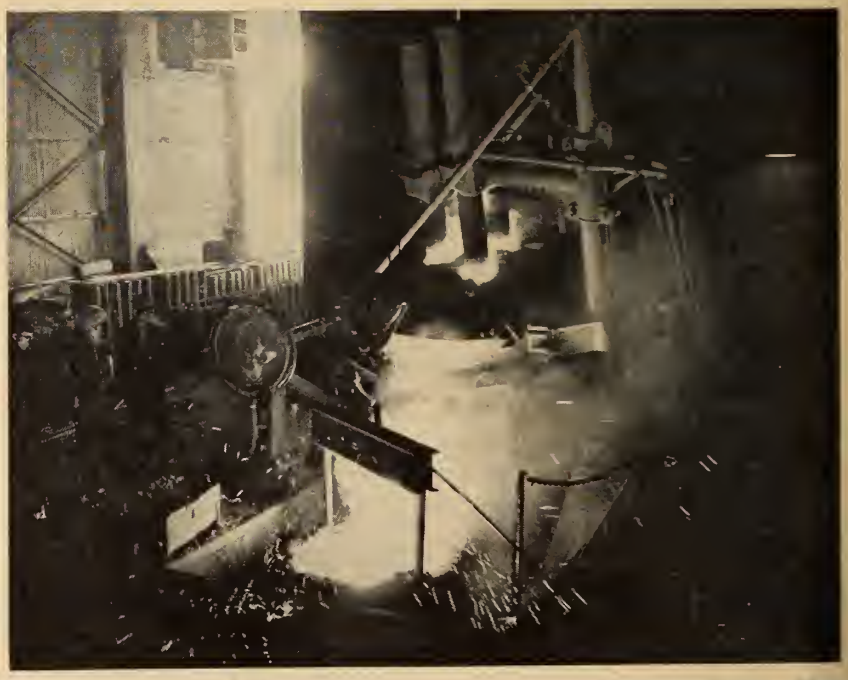
R. H. Tivy, M.E.I.C.,
News Editor

Electrical Section Sponsors Visit to Steel Mill

A very successful "season opener" was organized by the Electrical Section of the Branch when 150 members were guests of the Manitoba Rolling Mill Company Limited at their Selkirk plant on the evening of October 2. This plant is the only steel mill between the "Soo" and Vancouver.

The mill was first erected in Winnipeg, near the C.P.R. Weston Shops about 1909, by the American Horseshoe Company of Erie, Penn. Shortly afterward it was moved to St. Boniface, Manitoba. A few years later, it burnt down and was rebuilt in its present location about 1916. The rolled product at this time was produced from muck bar.

In 1918, the Company was purchased by Manitoba Bridge & Engineering as a wholly owned subsidiary. In the early 20's a 20-ton basic open hearth furnace was built and later a second unit of the same capacity was added. Originally, the open hearth furnaces were



Tapping a pour from the 3-ton electric furnace at the Manitoba Rolling Mills, Selkirk, Man.

heated with pulverized coal but this method of heating was found unsatisfactory and the furnaces were converted to bunker oil firing.

The addition of these units enabled the mills to roll from ingots rather than muck bars which, with the laboratory instituted at the time, resulted in more uniform and controlled product.

During the last war there was a large demand for shell steel and a 3-ton per hour electric furnace was added to the ingot-producing capacity.

For raw material, the plant is dependent entirely on scrap gathered in the area it serves.

Ingot making capacity is approximately 75,000 tons per year. Weights of the ingots range from 46 to 650 pounds each, and complete chemical and physical control is maintained on the product in the Company's laboratory. The product is fully killed carbon steel ranging from .09 to 1.00 per cent carbon content.

The mills consist of a 9-inch cross country merchant mill and a combination 20-inch and 16-inch cross country merchant mill. These mills have a total capacity of 65,000 tons of finished product per year, in rounds and squares to 3 inches, flats to 8 inches, angles to 4 inches by 4 inches, channels to 6 inches, tees to 3 inches, and some special sections for individual manufacturers.

Ingot heating for the 9-inch mill is accomplished in 2 bunker oil fired batch furnaces of sufficient capacity to keep the mill operating steadily throughout each turn. Furnaces are manually charged and discharged and the oil is atomized by low pressure air.

The 20-inch and 16-inch mills consist of a 3 stand cross country 20-inch mill and a 3 stand cross country 16-inch mill about 40 feet centre to centre. On certain sections the roughing stand on the 20 inch mill functions as a breakdown stand for the 16-inch mill, and on heavier sections the 20-inch mill will finish a section without the 16-inch mill. The customary roller conveyors are installed in the floor between mills to facilitate handling.

Ingot heating for these mills takes place in a 40-ft., 3 zone bunker oil fired rotary furnace. The heating cycle is fully automatic with the furnaces divided into 3 heating zones.

Preparations are now being made for an additional 4½ ton per hour electric furnace and a 10-inch cross country merchant mill similar in design to the present 9-inch mill.

The 10-inch mill will be finished early this fall and the 4½ ton electric furnace will be complete next spring. When these two new units are in full operation the capacity will be increased by 50 percent approximately.

All phases of the operation were in full swing during the visit and those attending were fortunate enough to see the tapping of one of the 20 ton open hearths with its dramatic rush of sparks followed by the white-hot, seemingly transparent flow of liquid steel running like water.

Also of great interest to the electricals present was the action of one of the electric furnaces after receiving a fresh charge of scrap. The huge cauldron seemed only barely to contain the 24,000 kva. and greater short circuits as showers of sparks were emitted from the livid and flickering arc, to the accompaniment of a rumbling, shuddering and growling which reminded the average engineer that it was as close to hell as he would like to get for the present.

Turning from the modern controls for the rolling mills and furnaces visitors were startled to find old "dobbin" hitched to a small car used for moving billets and scrap along the narrow gauge railway interconnecting the various buildings in the yard. At first glance it was almost as if the page had been turned back to the beginning of the industrial revolution and before. However the management assures us that experience and studies have shown that this is one place where this type of motive power is still the most efficient.

The tour was made possible through the courtesy of Mr. H. A. Mackay, president of the Company, and arrangements for the tour were handled on behalf of the Company by Mr. L. Bodie, manager of personnel and industrial relations, Dominion Bridge, Mr. J. S. Campbell, assistant general manager, and Mr. Hugh Smith, superintendent of the plant. "Arrangements" included a very excellent "charge" of coffee and sandwiches served by the Company at the end of the tour. Official thanks to the Manitoba Rolling Mills was extended during the coffee session by Ernie Scott, president of the Electrical Section.

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LIBRARY NOTES

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BOOK REVIEW

Estimating for building and civil engineering works: for the use of builders, public works contractors, architects, civil engineers and surveyors. Spence Geddes. London, Newnes, Toronto, British book service, c1951. 472 pp., tables, $12.75.

Somewhere in this title should be included the word "principles", as the author approaches his whole subject from a very practical angle. The result is a volume of equal value to both the builder and the civil engineer.

Estimates are based on British Standard Specifications and assume modern methods of construction in the latest types and sizes of modern plant, and also hand work, when no plant is involved.

Approximately two thirds of the book considers the various trades individually, alphabetically arranged. In each of these sections, principles, hypotheses, and costs are laid down and stated. Although all of these are United Kingdom and in sterling, they are worked out and presented in such a way as to make them basically applicable in any country. Specialized, various, and varied types of construction and development are considered under each section, and line drawings, graphs and tables on practically every page amply illustrate the author's findings.

The other third of the volume is what really makes the whole work of value on this side of the Atlantic. This deals with forms in which tenders may be invited; Individual elements of cost; Estimating the total cost; Tendering for work (including allowances for profit, etc.); The output of plant and labour, and the appointment of labour to plant and to tradesmen; and Working cost of plant per hour.

In addition to a detailed index, twenty-one pages of weights of materials are included, and a further twenty pages of all types of miscellaneous tables of value in the building trade.

This book merits the attention of all of you interested in any way in building or civil engineering. —E.K.

BOOK NOTES

Prepared by the Library
The Engineering Institute of Canada

Aerodynamics of the helicopter. Alfred Gessow and G. C. Myers. Toronto, Macmillan, c1952. 343 pp., illus., $7.00 (Canada).

This is a text for senior and graduate engineering students and engineers in the helicopter industry who are interested in obtaining a more thorough understanding of helicopter aerodynamics. The vast background of experimental and theoretical rotor work (comprising over seventy published papers) done by the NACA during the past fifteen years, serve as a sound basis for the material presented in this book. In presenting the subject matter, the authors have constantly endeavoured to give a physical treatment of the phenomena associated with rotating wings. Theory is developed in its most elemental form while lengthy mathematical formulae have been avoided whenever possible. Adequate illustrations, a detailed index and a vast bibliography are other attractive features of this book.

Coastal engineering. Proceedings of the second conference, Houston. November 1951. J. W. Johnson, ed. Berkeley, University of California. Engineering foundation council on wave research, 1952. 393 pp., illus., $4.75 (U.S.).

This is the second conference on coastal engineering, sponsored jointly by the Council on wave research, the Southwest Research Institute, and Texas A & M Research Foundation.

Neither the subject itself, nor the conference, need any introduction to those of our members interested in this very vital subject. We simply want to draw to your attention the fact that the second volume of these proceedings is now available.

Dictionary of conformal representations. H. Kober. New York, Dover, c1952. 208 pp., illus., $3.95 (U.S.).

This dictionary was written for the British admiralty during 1944 - 1948. Completeness in the sense of inclusion of all relevant conformal mappings has not been aimed at in this short book, apparently the first of its kind. The author has tried to deal with the subject in a systematic way and to fill the worst gaps. He has, on the whole, classified the conformal mappings according to the analytic functions $w=f(z)$ describing them. Conformal mappings of part three, however, have been classified according to the curves and regions that they map on certain curves and regions of the other plane or on the real axis and the upper half-plane. The book contains a topological subject index.

Handbook of heating, ventilating and air conditioning, 3rd ed. John Porges. London, Newnes, Toronto, British book service, c1952. Illus., $5.00.

This handbook has been compiled to fulfil a need for a concise manual containing all those data, charts and tables that are required many times a day by the heating engineer. This edition gives data on high pressure hot water heating, hot water heating, hot water heating by electricity and by gas, boiler feed water treatment, panel heating systems, heat pumps, flash steam recovery, schemes of air conditioning plants, automatic control, fume extraction plants and high pressure welding. A list of British standards applying to heating and ventilating, an index, tables and a bibliography are included.

Highway curves, 4th ed. H. C. Ives and Philip Kissam. New York, Wiley, c1952. 197, 389 pp., maps, tables, $8.40 (Canada).

This edition presents methods designed to simplify both field operations and mathematical solutions. To make the text effective, duplicate methods have been

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Bibliographies and Literary Searches

Short subject bibliographies are compiled on request.

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avoided, but those chosen have been given a complete treatment. The field methods have been selected for precision, speed and flexibility; the computation methods, for simplicity and lack of approximation. Many sections of "Field engineering" by Searles, Ives and Kissam, have been included. The treatment of compound curves and reversed curves has been simplified and extended to cover more problems. A relatively precise slide rule method of handling vertical curves has been introduced, while the theory for sight distances on sags and summits is rigorously developed. The book contains diagrams, an index and over three hundred pages of tables.

Manual of accident prevention in construction, 4th rev. ed. Associated general contractors of America, New York, American standards association, 1952. 257 pp., illus., $3.00 (U.S.).

This manual deals with the educational work of converting construction executives to the idea of active safety endeavour, and is also concerned with the way to proper organization and methods and with safe practices. It makes clear, by illustrations, specifications and simplified text, the safe way of performing construction work and emphasizes the costly results of incorrect, unsafe practices. In this fourth edition, the text has been reduced as much as was compatible with clarity, while numerous photographs, drawings, charts and tables have been included. It contains new sections on housekeeping, arc welding, gas welding and cutting, power saws, flammable gases and liquids, motor graders, bulldozers and tractors, and boats and barges.

Native trees of Canada: 4th ed. [Ottawa] King's printer [1950] (Bulletin no. 61 of the Dept. of Res. & Dvlpt., Forestry branches) 293 pp., illus., $1.50.

As this book has been on the market, in various editions, since nineteen hundred and seventeen, it may be a familiar publication to a number of our readers.

With an introductory section including Nomenclature, Botanical authorities, and Checklist of the native trees of Canada, the information is then arranged under types of trees, with all the types listed.

In most cases, the several stages of growth are illustrated, with close-up photographs of the leaves.

It is unfortunate that this book is not bound in proper board and buckram cover, as this would greatly enhance its value. However, it is still a useful addition to your bookshelves, particularly, if there are children in the household.

Problems of power transmission at voltages above 225 kV. François Cahen. London, British electrical and allied manufacturers' association, 1952. 64 pp., illus., 5/–.

These four lectures were originally delivered at London university in March 1951 and later published in the BEAMA Journal. They are entitled "General survey of the problems of power transmission at extra high voltages", "Problems of corona: power losses", "Problems of corona: the use of multiple conductors — radio interference" and "Over-voltages and surges: insulation protection and coordination". This publication is illustrated with many diagrams and photographs and contains tables and a list of references.

Sciagraphy. J. M. Holmes, New York, Pitman (1952) 580 pp., illus., $3.50.

The title word of this volume has various definitions, but all of them bearing in mind the one central concept, that is, the art of shading in drawing. The common technical use of the term now is the projection of shadows on to the drawn silhouettes of forms so as to indicate a third dimension. The presentation of sciagraphy in the simplest possible manner to be of the greatest possible value to the architect is the object of this volume.

It is divided into five major parts: points, lines and shapes; three-dimensional forms; complex forms; various forms; and built up forms; with an appendix, The Mathematical calculation of the angle A B C.

Each individual subsection is illustrated with the appropriate figures, and lines, shades, and angles.

This is a fairly small book, limited to a definite field, and is rather unique in that field.

It will be an invaluable addition to the library of anyone having to contend with the particular problem of sciagraphy in architectural drawing.

Science in Alaska: selected papers of the Alaskan science conference of the National academy of science, National research council, Washington, November 9-11, 1950. H. B. Collins ed. Arctic institute of North America. Washington, the institute, 1952. 305 pp., illus., $2.25 (U.S.). (Special publication No. 1).

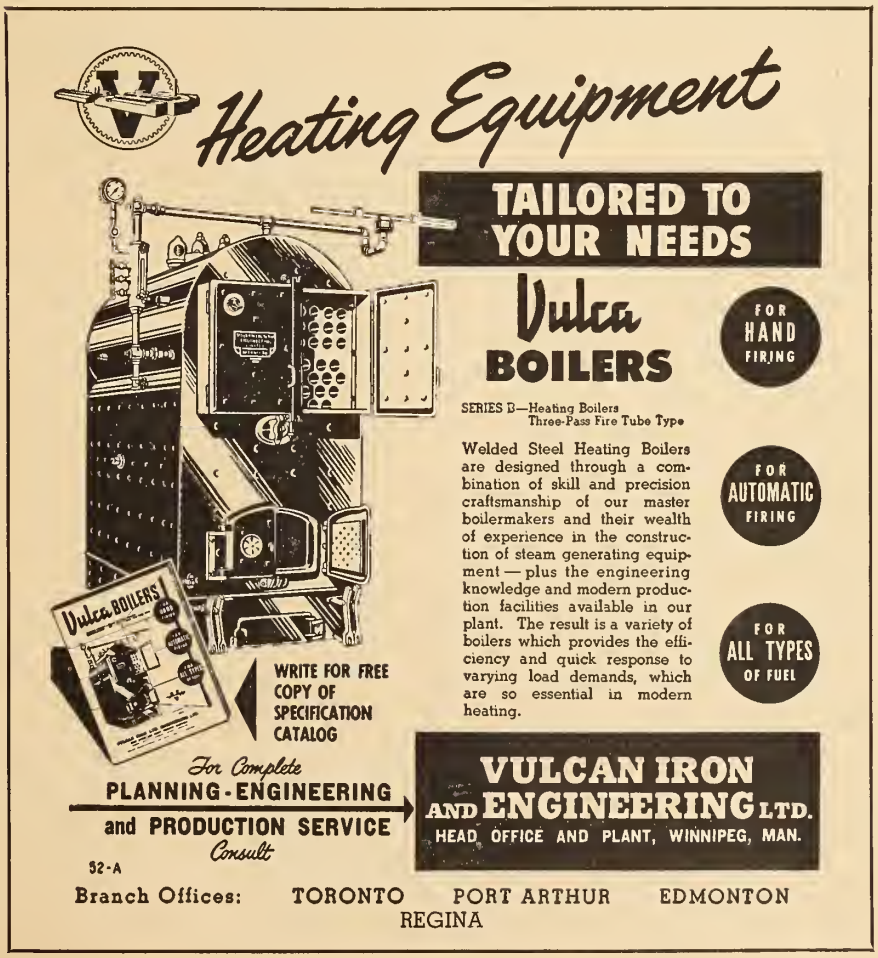
The Alaskan science conference, held in Washington in 1950 had as its main objectives the reviewing of the status of scientific research in Alaska, the appraisal of the major requirements for future research and the exploration of ways and means of developing new facilities and coordinating existing ones. Accordingly, these twenty-three papers deal with research done and to be done on the following subjects in regard to Alaska: agriculture and forestry, anthropology, botany, geology and geography, geophysics, meteorology, public health and medicine, and zoology. Each one contains a list of references and some are illustrated with diagrams or maps. As these papers represent the first broad survey of Alaskan science, they will be useful to anyone interested in this part of the continent.

Steam trap maintenance: system troubles, their diagnosis and treatment. A. S. Wadsworth. Manchester, Emmott, c1952. 27 pp., illus., 2/6. (Mechanical world monograph No. 66).

This monograph is not intended as a substitute for a careful study of correct trapping methods as published, but rather as a help to the engineer who does run into trouble, in locating and isolating the essential cause of such trouble. The understanding of this publication will ease the burden of the man who has to contend with an existing steam plant and maintain it in operation despite its built-in errors. The present work is illustrated and contains a "Steam trapping service chart".

Symposium on properties of metallic surfaces, advance copies of papers. Institute of metals. London, The institute, 1952. 293 pp., illus.

These thirteen papers were presented at the Royal institution on November



19th. The new following titles will give an idea of the aspects treated: "Specialized microscopical techniques in metallurgy", "Radioisotopes in the study of metal surface reactions in solutions", "The crystalline character of abraded surfaces", "Diffusion coatings", and "Chemical behaviour as influenced by surface condition". Bibliographies are appended to all papers. Some of these lists are very extensive. The papers also contain photographs, diagrams and necessary tables.

Thermochemical methods in silicate investigation. W. F. Eitel. New Brunswick, New Jersey, Rutgers university press, c1952. 132 pp., illus., $4.75 (U.S.).

The discussion of the methods applied to silicate investigation is extended in the present work beyond the fields outlined in White's "The modern calorimeter", in the strong feeling that modern concepts of the structure of crystalline material, and especially structure-energy relations, have a deep significance in theoretical mineralogy and petrology. Many of the special methods described herein have their origin in European laboratories. However, an attempt has been made to combine them with those of American investigators, especially Drs. Kelley and White. This book is indexed and illustrated and includes lists of references. Appendices contain numerical data on heats of formation, data for changes in state, heat capacity equations, etc.

TV troubleshooting and repair guide book. R. G. Middleton. New York, Rider, c1952. 204 pp., illus., $3.90 (U.S.).

The author has tried, in this guide, to eliminate, insofar as possible, theoretical explanations and to include only practical servicing information that can be put to daily use. He deals with receiver differences and normal operating waveforms, proper alignment techniques with instruments, sync and sweep troubles, video-amplifier circuits, high-voltage power supplies, test equipment, troubleshooting with minimum amount of equipment, receiver buzz and external interference. The present work is illustrated through photographs, diagrams and graphs, and is indexed.

Year book of the heating and ventilating industry. London, Technitrade journals, 1952. 284 pp., illus., 8/4.

This British yearbook contains a buyers guide (by products), a list of trade names and their owners, a list of manufacturers' addresses, a list of technical and trade associations, a membership list of the Association of heating and ventilating and domestic engineering employers, a heating and ventilating literature index for 1951 and a selected list of British standards. Apart from miscellaneous other information it contains four articles on physiology in regard to heating and ventilation, research at the National college, radiation, environment and comfort, and the necessity of air conditioning.

The following book notes appear here through the courtesy of the Engineering Societies Library of New York. The books may be consulted at the Institute Library.

Chemical engineering operations, Frank Rumford. New York, Chemical publishing company, 1952. 376 pp., illus., $7.50 (U.S.).

The purpose of this book is to provide an introduction to those processes which are peculiar to chemical plant practice. The general method of treatment is to survey the plants which have been developed to carry out the process under review and to give an analysis of the underlying principles without attempting an exhaustive treatment. Examples are given, if necessary, to illustrate the design of plant from these principles. Separate chapters are devoted to chemical works pumping, distillation, extraction, drying, mixing, filtration, size reduction, etc.

Fluorescent lighting. Edited by C. Zwikker. Eindhoven, Netherlands, Philips' gloeilampenfabrieken, Houston, Texas, Elsevier, 1952. 248 pp., illus., $6.25 (U.S.).

A review of the scientific and technical fundamentals and of the applications of the fluorescent lamp and its accessories. Owing to the differences between incandescent and fluorescent lamps emphasis is placed on the specialized design necessary for the most efficient use of fluorescent installations. In addition to full coverage of the principles and operation of fluores-

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cent equipment, many special adaptations are considered.

The technology of coated and processed papers. Edited by R. H. Mosher, New York. Chemical publishing company, c1952. 733 pp., illus., $15.00 (U.S.).

Intended for the technical worker, chemist, and engineer, this book presents a detailed picture of the modern raw materials, manufacturing processes and equipment, and formulations used in the various branches of the specialty — paper industry, discussing also the finished products and their evaluation. Written by specialists in the several fields the book emphasizes the contributions of new synthetic coatings, adhesives, and pigments. A previously published companion volume dealt with properties and uses of specialty papers.

BOOKS RECEIVED

The BEAMA catalogue 1952 - 1953. 2nd ed. British electrical and allied manufacturers' association. London, Iliffe, c1952. 1,003 pp., illus.

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

Canada's century. D. M. Lebourdais. Toronto, Methuen, British book service, c1951. 214 pp., illus., $4.00.

Electrical instruments meters and electronic control. E. Molloy ed. London, Newnes, Toronto, British book service, c1952. 196 pp., illus., $3.75.

Frontiers of personnel administration. Columbia university, department of industrial engineering. New York, the department, c1951. 151 pp., $12.50 (U.S.).

Gas turbine power. G. M. Dusinberre. Scranton, Penna., International textbook, Laurel, c1952. 256 pp., illus., $6.00 (U.S.).

Material handling in works stores: the fork lift and pallet system. L. J. Hoefkens. London, Iliffe, Toronto, Burns & MacEachern, c1952. 106 pp., illus., $2.65.

Mechanics. Vol. 1, Statics, Vol. 2, Dynamics. J. L. Meriam. New York, Wiley, c1952. 340 pp., 671 pp., illus., $4.80 per volume (Canada).

Mechanics of materials. Alvin Sloane. Toronto, Macmillan, c1952. 468 pp., illus., $5.50.

Modern plastics encyclopedia and engineer's handbook 1952, 16th ed. Plastics catalogue corporation. New York, the corporation, 1952. 848 pp., illus.

Proceedings of the Seventh annual time study and methods conference, New York, 1952. Society for advancement of management and American society of mechanical engineers, management division. New York, Society for advancement of management, c1952. 192 pp., $5.00 (U.S.).

Reviews of petroleum technology, Vol. 12, covering 1950. Ed. by George Sell and others. London, Institute of petroleum, 1952. 513 pp., £2. 10. 0.

The statesman's year-book: statistical and historical annual of the states of the world for the year 1952, 89th ed. S. H. Steinberg ed. Toronto, Macmillan, 1952. 1,586 pp., $9.00.

Steel defects and their detection. Henry Thompson. Toronto, Pitman, c1952. 83 pp., illus., $3.00.

A standard list of subject headings in industrial relations. Princeton University, Committee of university industrial relations librarians. The university, Industrial relations section, c1952. 95 pp., $2.50 (U.S.).

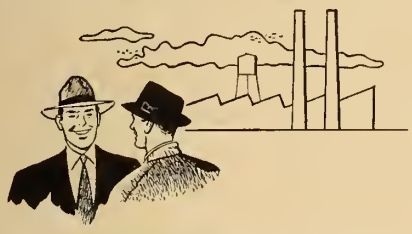
Storage tubes and their basic principles. M. Knoll and B. Kazan. New York, Wiley, c1952. 143 pp., illus., $3.60 (Canada).

Strength of materials. F. J. McCormick. Toronto, Macmillan, c1952. 177 pp., illus., $3.75.

Structural adhesives: the theory and practice of gluing with synthetic resins. Aero research. London, Lange, Maxwell & Springer, c1952. 203 pp., illus., 30/-.

Theoretical nuclear physics. J. M. Blatt and V. F. Weisskopf. New York, Wiley, c1952. 864 pp., illus., $15.00 (Canada).

Woods practical guide to fan engineering. W. C. Osborne and C. G. Turner ed. Colchester, Essex, Woods of Colchester, c1952. 227 pp., illus., $3.00 (Canada).



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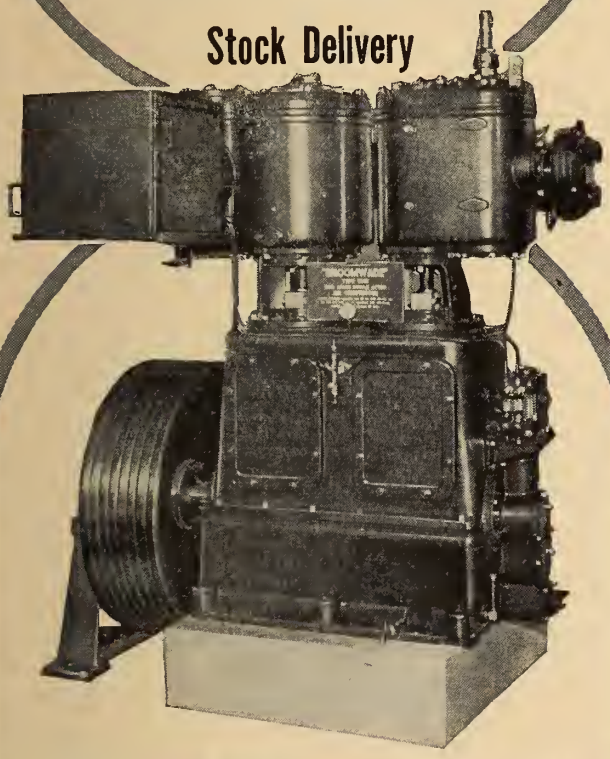

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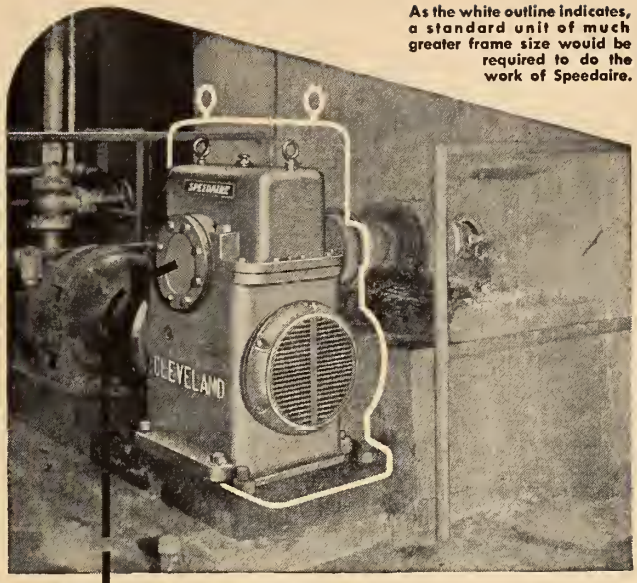

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BUSINESS & INDUSTRIAL BRIEFS

A Digest of Information received by The Editor

Appointments and Transfers

Allis-Chalmers Changes.—J. R. Lindsay has recently been appointed hydraulic engineer on special assignments at the head office of Canadian Allis-Chalmers (1951) Ltd. Mr. Lindsay was formerly manager of the Winnipeg district office.

R. E. Evans has been appointed manager, Winnipeg district sales.

W. G. Mayberry has been transferred to eastern district sales office in Montreal from head office in Lachine where he specialized in pumps and feeders for the pulp and paper industry. *(See November Personals re Mr. W. G. Mayberry,* M.E.I.C.*)*

•

C Z. Holmes.—Charles Z. Holmes has been appointed manager for the Chatham, Ont. branch of Geo. W. Crothers Ltd.

•

"Lucoflex".—Edward M. Webster & Company, 453 Aberdeen Avenue, Hamilton, Ontario, has been appointed Canadian distributor of "Lucoflex" rigid polyvinyl chloride plastic.

•

Canadian Trade Mission.—The Right Hon. C. D. Howe, M.E.I.C., will head a goodwill trade mission of government officials and businessmen to Brazil, Argentina, Uruguay, Venezuela, Colombia, the Dominican Republic, Haiti, Cuba and Mexico early in 1953. The mission will leave Ottawa, by air, on January 5th, and will return to Canada on February 10th.

The following businessmen will be part of the visiting group: D. W. Ambridge, president and general-manager, Abitibi Power and Paper Company, Limited, J. M. Bonin, managing-director, La Societe Co-operative Agricole du Canton de Granby, Quebec, C. B. Davidson, secretary, The Canadian Wheat Board, Manitoba, James W. Duncan, president, Massey-Harris Company Limited, who will also represent the Canadian Manufacturers' Association, Alex Gray, president, Gray-Bonney Tool Company, Limited, Toronto, who will also represent the Canadian Exporters' Association, and K. F. Wadsworth, president and general-manager, Maple Leaf Milling Company, Limited.

•

Truck Engineering.—Charles A. Shaw has been appointed Toronto branch manager of Truck Engineering Limited. Edward J. Powell has been named sales representative in the Toronto district.

•

M. K. Douglas

Amalgamated Electric Officers.—A. V. Armstrong, M.E.I.C., has been named president and managing director of Amalgamated Electric Corporation Limited. M. K. Douglas has succeeded D. M. Farish as secretary-treasurer. *(See Personals re Mr. A. V. Armstrong,* M.E.I.C.*)*

•

Defence Production Department.—The following changes have been made in the Department of Defence Production. F. V. C. Hewett, who has been director of the non-ferrous metals division, has resigned and returned to private consulting work in Toronto. He is succeeded by Norman B. Davis.

Dr. J. R. Donald, M.E.I.C., has resigned as director of the chemicals and explosives division. The division will be disbanded and the remaining problems in the chemical and explosives field will be handled by Dr. H. H. Saunderson, the coordinator of the materials branch.

The pulp and paper division has also been disbanded and R. M. Fowler, who was serving as director of the division, has returned to the Canadian Pulp and Paper Association of which he is president. *(See Personals re Dr. J. R. Donald.)*

•

Dominion Oxygen Changes.—Dominion Oxygen Company of Canada Limited has announced these two new appointments. Edward H. Doyle, formerly district manager at Winnipeg, has been appointed manager, distributor and apparatus sales. He will make his headquarters at the general offices of the Company at 40 St. Clair Avenue East, Toronto. J. Stuart Johnston, M.E.I.C., has succeeded Mr. Doyle as district manager with headquarters in Winnipeg. *(For further information on Mr. Johnston see Personals.)*

•

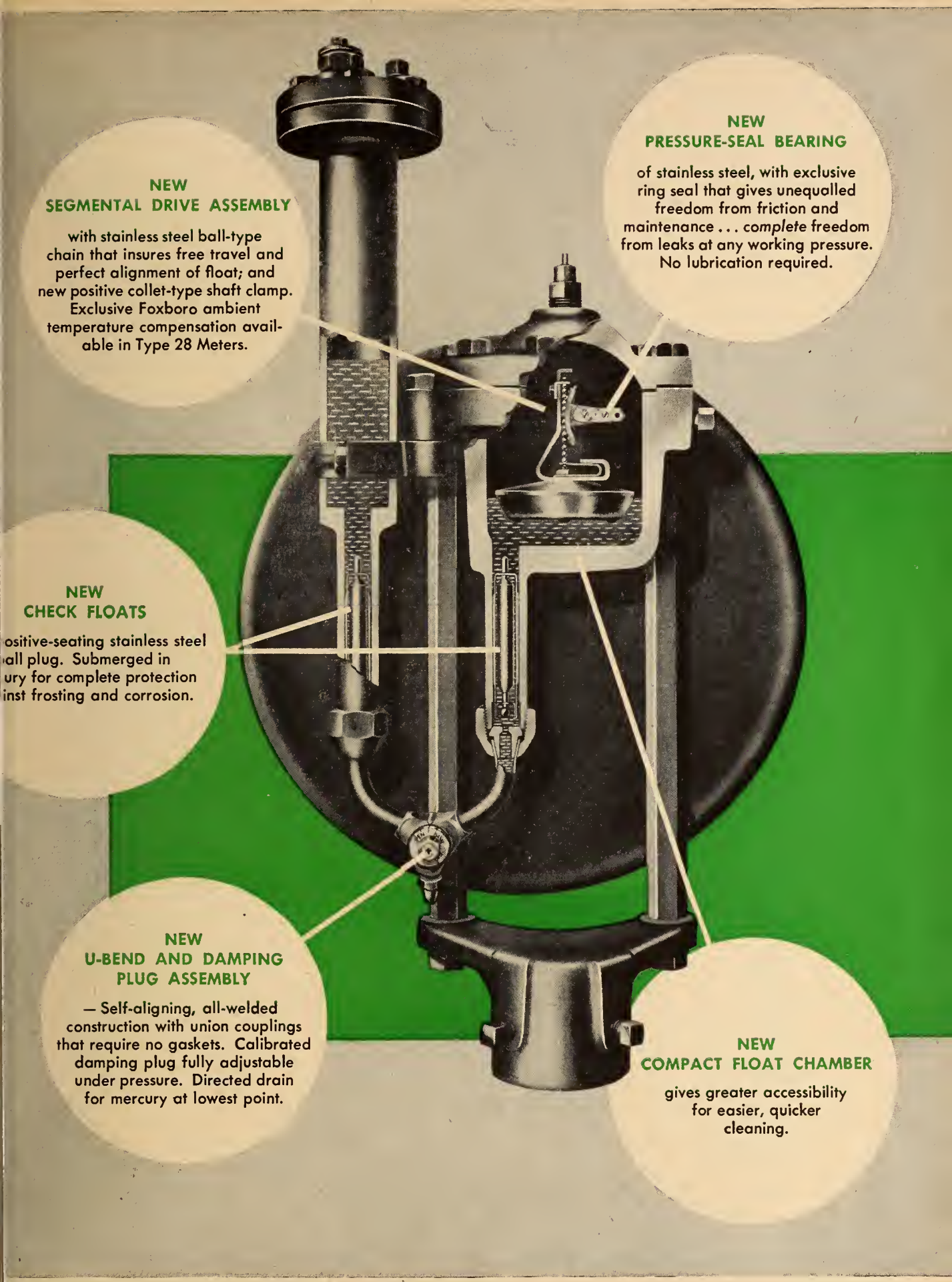
Goodyear Advertising.—Allan E. Ross has been named advertising manager of the Goodyear Tire & Rubber Company of Canada, Limited. He is a graduate of the University of Western Ontario.

•

Bepco Changes. — Senior executive changes in Bepco Limited have been made. C. G. Abbey of Montreal, formerly president and general manager, is now occupying the newly created position of chairman of the board. He will be succeeded in the presidency by Brian M. Burt of Montreal. Mr. Burt has been associated with Mr. Abbey as vice-president and chief engineer since the establishment of the Company. F. E. Regan of Toronto, Ontario branch manager, has been elected to a vice-presidency of the Company. *(See Personals re Mr. F. E. Regan,* M.E.I.C.*)*

•

C.G.E. Reorganization. — Canadian General Electric Company Limited announce the following changes and appointments as part of a broad-scale de-centralization of the operations of the Company. J. H. Smith, M.E.I.C., has



A CANADIAN PRODUCT BY THE FOXBORO CO., LTD.

announced the three headquarters departments which will integrate the division's nation-wide distribution organization. W. Frank Wansbrough has been named manager—marketing; John C. Denison, manager—finance; Edward T. Burns, manager—operations. The wholesale division is a self-contained operating unit, responsible for the distribution of GE products serving mass-markets, including industrial and construction equipment, supplies, lamps and appliances.

V. B. Ross has been appointed assistant to works manager at the Company's Davenport Works.

•

New Equipment and Developments

New Brampton Plant.—Officials of the Union Metal Manufacturing Company of Canton, Ohio, anticipate that initial production of their new plant in Brampton, Ontario, will commence within a very short time.

The initial production is to consist of parking meters for the Company's dual parking meter division. As soon as circumstances permit work will be commenced on the production of switch boxes, meter enclosures and similar products of the Company's switchboard and devices division.

The new plant will be known as the Union Metal Manufacturing Company of Canada, Ltd. V. J. Lajeunesse of Canton, Ohio, has been named president and O. L. Beatty of Preston, Ontario, has been named general manager of the new plant.

•

Chiksan of Canada Ltd. — Chiksan Company has established a wholly-owned Canadian subsidiary. The new subsidiary will operate under the name of Chiksan of Canada Ltd.

Over 9 acres of property have been purchased by Chiksan, in Brantford, Ontario, where it is planned to construct a plant on the site for the manufacture of Chiksan ball-bearing swivel joints. Construction will commence early in 1953.

When in operation, Chiksan of Canada Ltd. will take over the distribution and sales of all Chiksan and Weco products now being handled by Chiksan Export Company in Canada.

The establishment of the new subsidiary will not affect the distribution of Chiksan products in Canada by G. W. Beecroft & Company of Toronto, and Lynn, MacLeod Engineering Supplies, Ltd. in Montreal, Lachine, and Thetford Mines.

•

New Foxboro Product.—Accurate positioning of cylinder-operating devices is the function of the new "Poweractor Positioner", introduced by The Foxboro Company, Foxboro, Mass. Designed especially for use with the Foxboro Stabiload Cylinder the Poweractor unit will position equipment requiring long stroke and power, such as large size control valves, dampers, variable speed drives, Saunders and pulp stock valves, through pneumatic cylinder (or springless diaphragm) operating mechanisms. For complete details write to Peacock Brothers Ltd., Ville LaSalle, Montreal, who are Canadian agents and distributors for the Foxboro Company.

•

Engineering Conference. — Recently Canadian Fairbanks-Morse Company Limited held an engineering conference of Diesel, pump and electrical sales engineers. The meeting was held in Montreal. The purpose of the meeting was to bring the Fairbanks-Morse personnel together for an up-to-date briefing on the latest developments in Diesel engines, pumps and electrical equipment. Chairman of the conference was J. H. Maclure, assistant manager of the engine, pump & electrical division.

•

New Carbon & Graphite Source.—A new source of carbon and graphite materials for electric furnaces and casting operations has been opened to Canadians with the recent formation of the Great Northern Carbon & Chemical Company with head office in Montreal.

The new Company, an independent sales organization, will act as exclusive Canadian agents for several divisions of the Great Lakes Carbon Corporation. The parent concern manufactures carbon and graphite electrodes, anodes, graphite mould stock, miscellaneous powders heat exchangers and raw and calcinated coke. Specialty among Great Northern

products is the graphite electrode. Perfection of this electrode has made possible the electric arc furnace.

Key personalities in the formation of the Great Northern Carbon & Chemical Company are George Terrien of Nashua, N.H., and Howard Bartram of Montreal.

•

New Welding Torch.—A new water-cooled Heliarc torch for inert gas-shielded arc welding is announced by Dominion Oxygen Company Limited. The torch has a rated capacity for continuous duty of 225 amperes, and either high-frequency stabilized alternating current or straight polarity direct current can be used. This new torch — the HW-10, is designed for welding practically all commercial metals up to about ⅛ in. thick.

For complete information communicate with Dominion Oxygen Company Limited, 40 St. Clair Avenue East, Toronto 5, Ontario.

•

Shawinigan Water Reserves.—In reporting on the activities of the Shawinigan Water and Power Company during the first nine months of 1952 J. A. Fuller, president of the Company, said that the directors had decided to establish a water storage equalization reserve, which will provide for periods of subnormal rainfall in the future when purchases of power have to be increased. At the end of September 1952 there was 83.3 per cent more water available in the St. Maurice system storage reservoirs than at the same time last year. During the nine months covered by the report the expenditures for the purchase of power were reduced 15 per cent.

•

Thompson Products New Plant.—Construction of the new $6,000,000 Thompson Products jet aircraft engine parts plant in Grantham Township, Ontario, is nearing completion. The first manufacturing scheduled for the new building has commenced.

The completed building will have a floor area of 150,000 square feet.

The Company has been awarded a contract for producing a composite turbine wheel for the Avro Orenda jet engine. Another contract for producing essential components for the British Sapphire jet engine has also been received.

•

Drawing Templates. — Having noted the time that draftsmen in engineering and architectural offices require to draw plant equipment to reduced scale on mechanical building plans, Darling Brothers Limited has prepared a complete set of templates in convenient kit form showing three different standard scale drawings of various Darling products.

The sheets can be easily slid under tracing cloth or paper, and the design traced quickly. There are three scale sheets for each type of pump, for instance, which can easily be found and withdrawn from the kit. The sheets are not bulky or thick and they have been prepared to ensure durability.

The entire set, which will cover all major lines of this manufacturer, is contained in a special binder, which can be hung on the wall or kept flat in a drawer. The Darling equipment covered to date includes Class D Pumps, Class R Pumps, Type K Heaters, and Type R Convertors. The cost of the preparation and production of this kit has been great but the Company is prepared to sell them at a fixed nominal charge of three dollars per kit. Additional sheets, now in preparation, will be mailed to kit owners at no extra charge. Address inquiries to the Company at P.O. Box 187, Montreal.

•

New Sturtevant Fans.—B. F. Sturtevant Co. Ltd., Galt, Ontario, has introduced a new multi-purpose industrial fan. It is designed for improved performance and much greater efficiency. The new fans are known as series 600, 700, 800. They are basically constructed to handle air, material and long shavings. These wheels lend themselves readily to many different applications.

The air handling wheel (No. 600) is for exhausting smoke, fumes, gases and lighter industrial dusts. The material handling wheel (No. 700) is for general industrial uses where sawdust, granular material and chips are encountered, and the No. 800 series long shavings wheel is for special applications involving long, stringy or fibrous materials.

Housings are convertible as to discharges in all sizes. The wheels are all of the cone back plate type for sturdy construction. Heavy-duty ball bearings are furnished as standard for long service with minimum maintenance. Standard accessories include both bolted type and quick-opening access doors, flanged inlets and outlets, and outlet dampers.

The industrial fan is available with rubber lining with a variety of special coatings. It can be constructed of special metals to meet hazardous, explosive or corrosive conditions. The industrial fan can be provided with cooling wheel and oil-lubricated ball bearings for high temperature applications up to 900°F. The industrial fan is made in 11 sizes with capacities ranging from 670 to 44,000 cfm and pressures up to 16″ water gauge. For complete information write to the Company.

•

Sulphur Control Revoked.—On November 17th the Department of Defence Production announced that the control order on sulphur was being revoked effective on the date of announcement.

As allocations of sulphur continue to be recommended by the International Materials Conference, major users will be asked for specific reports so that the supply situation in Canada may be kept under review.

•

Huge Earth-mover Tires.—Giant earth-mover tires for use in large building projects are now being built in Canada by The Goodyear Tire & Rubber Company of Canada, Limited. These off-the-road tires cost up to $2,000 apiece and weigh close to 1,000 pounds. They stand five feet, eight inches high.

Three men take eight hours to prepare material and build each 21.00.24 tire. Raw materials per tire include 640 pounds of rubber, and more than 100 miles of rayon-cord. Initial capitalization to provide special machines for production amounted to more than a quarter of a million dollars.

•

Gardner-Denver Production. — The WXO, two-stage air-cooled air compressor is one of the several Gardner-Denver products now being made in Canada at Brantford, Ontario.

•

New Yarn Brake.—An improved hysteresis brake that holds constant tension on yarn, wire, etc., by magnetic drag instead of friction, has been announced by the apparatus division of Canadian General Electric Company.

The brake consists of alnico magnets so designed and mounted that a magnetic drag offers a restraining force on a pulley. This force is essentially constant at all speeds and can be adjusted simply by turning the calibrated head mounted above the pulley.

According to Company engineers, the new brake reverses the direction of rotation a few degrees after stopping, thereby holding stalled tension. The inertia of the brake itself is slight enough that yarn does not become unthreaded during quick acceleration and deceleration.

The construction of the brake permits operational speeds up to 700 yards per minute while tension control ranges from 3.5 to 10.5 grams.

For complete details communicate with the Company at 212 King St. West, Toronto 1.

•

Flameproof Limit Switch.—The flameproof limit switch made by Siemens-Schuckert (Great Britain), Ltd., Faraday Works, Great West Road, Brentford, in the English county of Middlesex, is built in accordance with the flameproof requirements for Group I and II gas. It consists of a double-break, single-pole switch with two normally open and two normally closed contacts enclosed in an aluminium-alloy casing. One end of the enclosure carries a boss through which slides a large diameter operating plunger, the end of which is furnished with a roller to give a smooth action. The other end of the enclosure takes a compound-filled gland for wire-armoured cable up to ¾-inch diameter under armour, or a gland to take up to ¾-inch conduit. At the gland end the enclosure carries a three-way moulding with socket inserts. A similar moulding is fitted into the gland and the sockets are connected by contact pins. In this way the gland can be readily mounted on or removed from the switch enclosure without disturbing any electrical connections. The dimensions of the switch enclosure are about 6 inches by 4 inches by 3 inches and the overall length of the unit, including the operating plunger and gland, is about 17 inches with a gland for armoured cable and 16 inches with a conduit gland.

•

More Powerful Engines For Giant Air Troop Carriers.—The second and third Princess flying boats now building at the Isle of Wight in Southern England, are to have more powerful engines even than the Proteus II, the type to be installed in the first aircraft of the series. The ten turboprops to be installed in this first 140-ton machine, which is scheduled soon to make its first flight, will already give an aggregate output of 35,000 horsepower. They will enable the flying boat to fly 200 men non-stop for a distance of 3,500 miles.

The engines to be fitted in the second and third of the Princess aircraft will be

the Proteus III. The same type will be installed in the second Brabazon, the 130-ton landplane. These latest engines are not yet available and it has therefore been decided to suspend work on these last three aircraft pending completion of the power units.

Some idea of the immense value of the Princess flying boats can be gained from the fact that when all three aircraft are in service their yearly troop-carrying capacity will be equivalent to that of nine normal-sized troopships.

●

Metal Scaffold Bracket. — For use in electric power stations and sub-stations or, in fact, for any type of building involving the use of scaffolding, is the "Robell" metal scaffold bracket. This is a patented, all-welded device which does away with many of the disadvantages of ordinary scaffolding construction. The "Robell" bracket is designed to be placed through the windows or other openings to enable joiners, plumbers, painters and others to complete the final stages of construction, such as roofing, guttering, moulding, painting, in greater safety and comfort. This bracket, it is claimed, makes for economy, faster production, rapid erection and dismantling and saving in timber, among other advantages. (Robert Bell, 8, Chester Road, Hazel Grove, Stockport, Cheshire, England.)

●

Mobile Service Station. — For carrying out regular vehicle maintenance service in the most remote places, a complete, mobile service station in a very compact form is now available. This, it is claimed, is particularly valuable on big development schemes in all parts of the world, where a number of vehicles have to be serviced regularly, and it is impracticable to take them to a service station. This unit can be supplied for mounting on a truck for transportation and operation or complete with two-wheeled chassis. Standard equipment includes an air compressor, high pressure air-operated grease dispenser pump, three low-pressure, air-operated oil dispenser pumps, penetrating oil sprayer, hose reels, hose, tyre inflator gauge, and air lines. Tecalemit, Ltd., Great West Road, Brentford, Middlesex, England.)

●

Neon Voltage Indicators. — Two neon voltage indicators for use in testing low and medium mains installations have been re-introduced. The pencil type, Q.5000, can be used on alternating or direct current mains voltages between 110 and 500. It is housed in a black insulating pencil-shaped case with a pocket clip. The voltage and polarity indicator, Q.5005, is a much larger type suitable for 80/750 volts a.c., and 100/750 volts d.c., and for indicating polarity on direct current. It has two black Philite moulded insulated test prods, fitted with collars to prevent accidental hand contact with the metal probes. (Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2, England.)

●

Ammeters And Voltmeters. — Switchboard moving-iron ammeters and voltmeters ("C.K.A." pattern) with 4-inch diameter dials and 6½-inch long 240 degrees circular scales, are the latest additions to the range of instruments available from a well-known London firm in this field. These have been developed to meet the demand for a compact long-scale instrument, available at a price that compares favourably with that of the short-scale instruments. (Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2, England.)

●

Roofing Tile Cutter. — Claimed to be able to cut all classes and all shapes of roofing tiles, the "Laco" super tile cutter is extremely simple to operate. All that is necessary is to clamp the tool in a suitable position and pass the tile along the cutting edge once only. A unique feature is that it will cut accurately and with ease tiles having reinforced edges or irregular under surfaces. (Lawler, Ayers and Co. Ltd., 54, Old Broad Street, London, E.C.2, England.)

●

(*Continued on page 1383*)

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C. M. Lovsted & Co. (Canada) Limited, Vancouver

BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1376*)

World's Largest Mine Fan. — The world's largest single axial flow mine fan, with a diameter of 17½ feet, has been built by Walker Bros., Pagefield Engineering Works, Wigan, in the English county of Lancashire. The fan will be shipped to Australia for installation in a zinc mine at Broken Hill. The fan, which is so large that an 850 horsepower electric motor will be needed to drive it, has two 44,800 lb. units, both of which will be mounted on a carriage. One will act as a standby which can easily be moved into place in an emergency. The fan will cope with one million cubic feet of air per minute. No difficulty is expected in moving it and its steel casing, as it is to be broken down into small sections for easy transportation. Variable-pitch phosphor-bronze rotor blades to a new design will permit the fan—by means of a combined variation in the speed setting of the motor—to be run to exhaust air from the workings at a minimum quantity of three quarters of a million cubic feet of air per minute.

•

Rubber Lining For Reservoir. — Rubber lining of an underground reservoir situated between Sunderland and West Hartlepool, in Northern England, is believed to be the first project of its kind to be attempted in the world. Work on this reservoir, which measures 750 feet long by 300 feet wide and is 18 feet deep, is being undertaken by Dunlop Rubber Co. Ltd. (General Rubber Goods Division), Cambridge Street, Manchester 1, England.

The reservoir is sited across a hard rock ridge which has coal deposits on either side and is laid in a bed of sand. The working of the coal, however, caused major subsidences, which in turn developed cracks in the reservoir. Although major subsidences are now considered to have ceased, fine cracks are still occurring, with consequent serious water losses. It was considered that rubber—a tough, extensible material—would absorb the slight movement which causes the minor cracks, and a method of applying a rubber lining was evolved following discussions between the water engineers and Dunlop technicians. Before carrying out any major part of the work, a portion of the reservoir was lined on an experimental basis, proving that the application of rubber is a practical and economic proposition.

The next stage is to prove that a rubber lining applied by this method will retain water satisfactorily and remain unaffected by the development of fine cracks in the reservoir's rigid structure. To this end, the mixing chamber of the reservoir is to be lined and, if successful, work will begin on the entire project, necessitating about 448,000 lb. of rubber.

Lining of chemical plant with a wide variety of materials to resist corrosion is carried out by Dunlop's General Rubber Goods Division, at their own factory or on the customer's premises. The materials used are soft rubber, ebonite, butyl, polyvinyl-chloride, and neoprene. The outstanding property of P.V.C. is its superior resistance, at temperatures up to 60 degrees Centigrade, to acids such as nitric, chronic, hydrofluoric and mixtures of these, at concentrations which have a severe deleterious effect on comparable materials such as rubber.

•

Stud Threading Machine. — Simultaneous threading of both ends of studs is done on a machine developed by J. W. Bamkin and Company, of Harrison Road, Leicester, England. It has a capacity for studs up to 4 inches long and up to 7/16 inch diameter in high-

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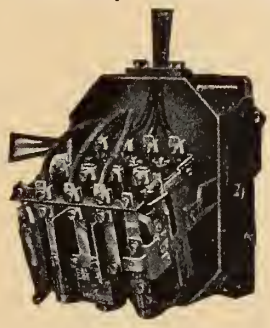
Type "SCF" Magnetic Starter.

Maximum rating 3 H.P., 550 volts, 3 phase. Fitted with maximum of two overcurrent relays with oil dashpot time lags. This compact design gives close protection to motors taking currents as low as 0.085 amps.



Type "SC1" Magnetic Starter.

Maximum rating 7½ H.P., 550 volts, 3 phase. Cover removed and interior partly withdrawn to facilitate access to line and motor terminals. Fitted with three overcurrent relays.

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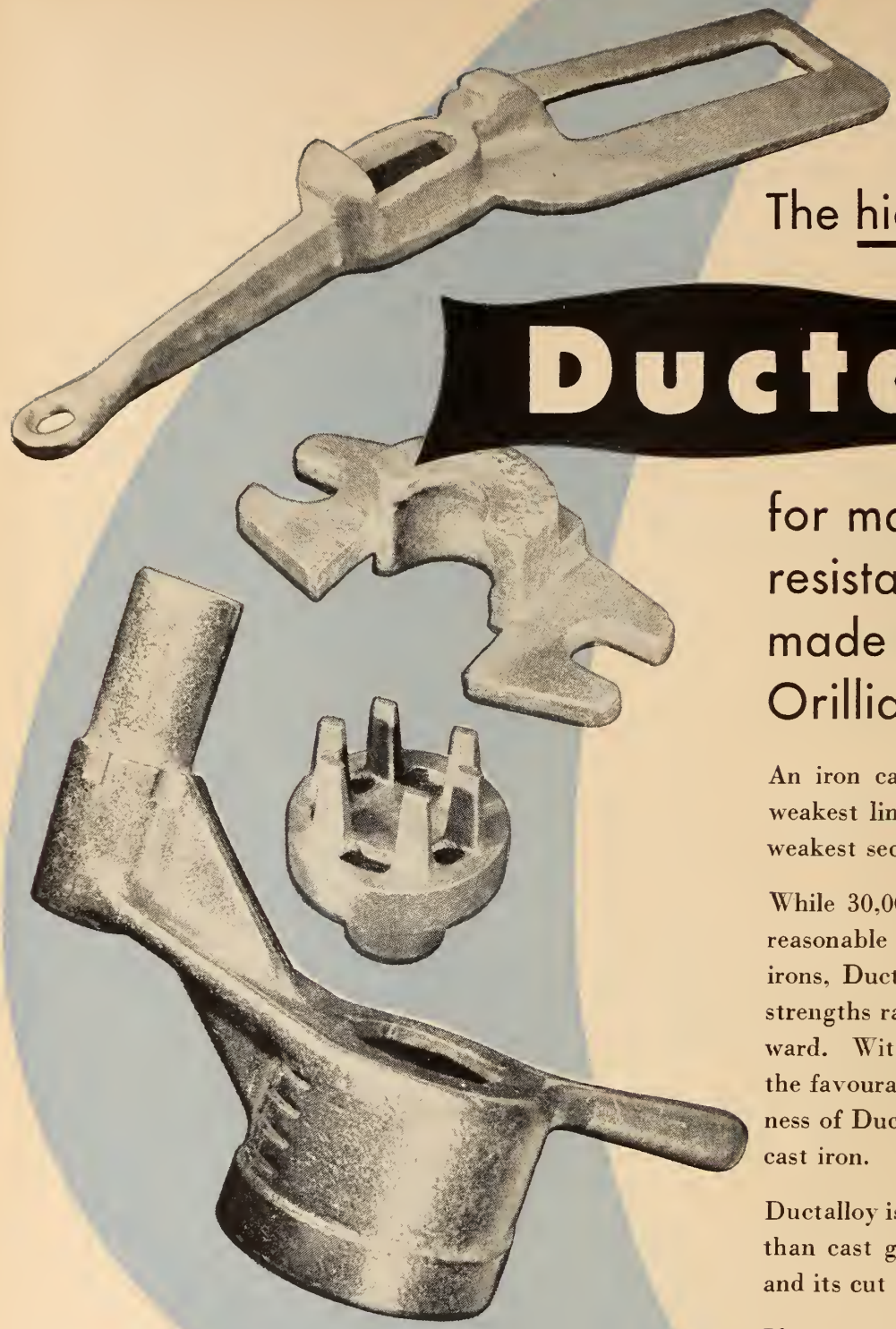

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An iron casting, "like a chain and its weakest link", is only as strong as its weakest section.

While 30,000 p.s.i. tensile strength is a reasonable average for ordinary cast irons, Ductalloy is available in tensile strengths ranging from 65,000 p.s.i. upward. With this high strength, due to the favourable graphite form, the toughness of Ductalloy is many times that of cast iron.

Ductalloy is much more easily machined than cast gray iron of similar hardness and its cut surfaces are smoother.

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tensile steel and up to ½ inch diameter in mild steel and is suitable for studs such as are used in automobile and diesel engine cylinder blocks. The machine is 6 feet 2 inches long, 4 feet 6 inches wide and 4 feet high.

Blanks are fed from a magazine, and after the magazine is loaded the action is completely automatic. A blank from the magazine is pushed into a collet which grips it whilst its first end is threaded. By reason of the advancement of the next blank into the collet the first blank is moved into a transfer device by means of which it is fed into another collet for the threading of its second end.

A range of 24 cutting speeds is provided from 70 to 600 revolutions per minute and they are selected by means of pick-off gears. The cycle time is variable, there being twenty-two cycles, from two to 50 seconds, and all are available for each cutting speed. The threading sequence and the operation of the transfer device are controlled by cams.

A motor-driven coolant pump feeds cutting fluid through the centres of the threading spindles. The machine will accommodate most makes of rotating die-head and it is stated that one operator can look after three machines.

●

High Torque Speed Reducer.—A reduction gearbox of larger capacity than the company has previously manufactured has been introduced by Varatio-Strateline Gears, Ltd., of Slough, in the English county of Buckinghamshire. Known as type "F", the gear follows the normal principle of the "Strateline" range in that the input and output shafts are co-axial, the method of reduction consisting of an outer stationary ring meshing with an eccentrically rotating pinion. The gear is supplied for vertical or horizontal mounting either as an independent foot-mounted unit or motorised with the motor integral with the unit. The horsepower required to drive the gear is governed by the output speed and torque required. This horsepower may vary from 2 for reductions up to 100:1 to as high as 12 for reductions of 20:1.

●

The "Forgemaster".—Every time a billet goes under a new forging press installed at a stamping works in Coventry, England, it saves seven blows from the machines in the hammer shop. To produce the same stamping with a hammer nine blows would be needed. This "Forgemaster", built by Wilkins and Mitchell, Ltd., of Darlaston, in the English county of Staffordshire, shapes and stamps with two mighty bangs.

Until recently a large proportion of all the presses used in the United Kingdom were made abroad, but the "Forgemaster" takes up less than half the floor space of its rivals, does the work more quickly and is more economical in the use of metal. At present the "Forgemaster" is engaged on the high-speed experimental production of motor-vehicle forgings.

●

Inclinable Presses.—Among machines recently introduced by F. J. Edwards, Ltd., of 359, Euston Road, London, N.W.1, are the "Besco" Mark II presses. These inclinable presses are made in three sizes: they have adjustable lengths of stroke variable from ⅜ inch to 1⅞, 2⅜ and 2¾ inches. Pressures exerted by these machines are respectively 22,400, 17,920 and 40,320 lb.

The press ram has adjustable V-jibs and its width over the slides varies according to the size of the machine from 7¾, 9 and 9¾ inches: the smallest ram has a tool hole 1½ inches in diameter whilst the hole in the two larger rams is 2 inches in diameter. Movement is transmitted to the ram by a ball-ended screw which affords adjustment of the working heights of the ram.

The platen and the bolster are both T-slotted. The widths and depths of the three platens are respectively 16 x 9½ inches, 19½ x 11½ inches and 22¼ x 13½ inches, the platens being pierced by holes for the passage of pressings, measuring respectively 8 x 6 inches, 9 x 7 inches and 10½ x 8 inches. Bolsters are 1¾, 2½ and 2¾ inches thick.

The forged nickel-chrome-molybdenum steel crankshaft has an adjustable friction damper or brake to prevent over-running while a safety pawl prevents reverse action. A roller-key type clutch permits continuous workings or a single stroke action. When set for single stroking, continued depression of the pedal will not give repetition of strokes. The press is driven by a 400-440 volts, 3-phase, 50-cycles motor. Motors for the various machines are rated at 2, 3 or 4 horsepower respectively at 750 revolutions per minute.

●

Lightweight Accumulators For Aircraft.—A series of light-weight accumulators recommended for aircraft has been announced by Time Switches, Ltd., of New Malden, Surrey. These may have as little as one-fifth the size and one-sixth the weight of comparable accumulators of conventional design, state the makers.

The positive elements of these new accumulators, are of silver, prepared by a special process, and the negative elements are of metallic zinc. Both elements are encased in semi-permeable membranes which provide insulation and separation. The methods of construction avoids the use of pasted grids, with consequent reductions in both weight and size. The electrolyte, which is potassium hydroxide, is in an absorbed condition, there being only a small excess of liquid to act as an indication of sufficiency, making the cells virtually unspillable.

The outer case of the accumulator is of Perspex. A 10-ampere-hour, 6-volt accumulator has a weight of 31 ounces (880 grams). A 12-volt accumulator of similar capacity weighs 3 lb. 14 oz. (1.7 kilograms) and a 40-ampere-hour, 12-volt battery has a weight of just 13 lb. (under 6 kilograms).

Apart from their lightness, these silver-zinc accumulators have the advantage that they will not boil in conditions of high altitude or low pressure. They work effectively at temperatures down to —30 degrees C, and no damage results from complete freezing which occurs at —59 degrees C.

●

Climax Chain Belting.—The increased use of mechanical handling appliances has resulted in a greater demand than ever for the products of a United Kingdom firm. The company's range includes Climax tested chain belting, sprocket wheels, elevator buckets, and other accessories for mechanical handling equipment. Great quantities of Climax tested chain belting are now being supplied to all countries, particularly New Zealand and Canada, for use in the timber industry.

The firm possesses a very comprehensive range of American-type link patterns: these have been made from samples obtained from abroad and their chains are therefore interchangeable with those of American manufacture.

Apart from the timber industry in Canada, chains made at their works are widely used in the sugar industries of South Africa, Australia, India, Mauritius and the West Indies. They also supply large quantities for the cement industries in Brazil and for industrial and agricultural purposes in South Africa, New Zealand and Denmark. The makers are John King and Co. (Leeds) Ltd., of Garnet Road, Leeds 11, in the English county of Yorkshire.

Publications

For copies of the publications mentioned below please apply to the publishers at the addresses given in the items.

Please mention *The Engineering Journal* when writing.

Wet Blasting. — A new brochure, "Wet Blasting in Precision Finishing", has just been published by American Wheelabrator & Equipment Corporation, 1112 South Byrkit Street, Mishawaka, Indiana. This six page brochure shows the application of wet blasting to such work as die and mould finishing, die and mould maintenance, tool finishing and deburring, heat treat scale removal, and surface preparation for plating in all applications where close tolerances on work must be maintained. Write to the Company and ask for bulletin No. 43.

●

Locknuts. — "Locknuts" is the title of a 24 page publication issued by the Locknut Section of Industrial Fasteners Institute, Cleveland 15, Ohio. The brochure has been prepared as a means of assisting in the most effective use of locknuts. A study of the descriptions and illustrations provide useful information leading to successful application. Under each section, the names of the companies manufacturing the various locknuts are given. To obtain a copy of the brochure, write to the Institute at 3648 Euclid Ave., Cleveland 15, Ohio.

●

Transformer Stocks.—From time to time Ferranti Electric Co. Ltd., Mount Dennis, Toronto 15, issue a list of standard transformers in stock at the Mount Dennis factory and at the Montreal and Winipeg branches. To be placed on the regular mailing list for receipt of these stock lists, write to the Company.

●

Atlas Steel News.—No. 2, volume 6 of Atlas Steel News contains items entitled "More Power to British Columbia", "The Heat Treatment of High Speed Steels", "Trapping Tramp Iron", "Stainless Golf Club Heads". To be placed on the list for regular receipt of this publication, write to Atlas Steels Company Limited, Welland, Ontario.

(*Continued on page 1391*)

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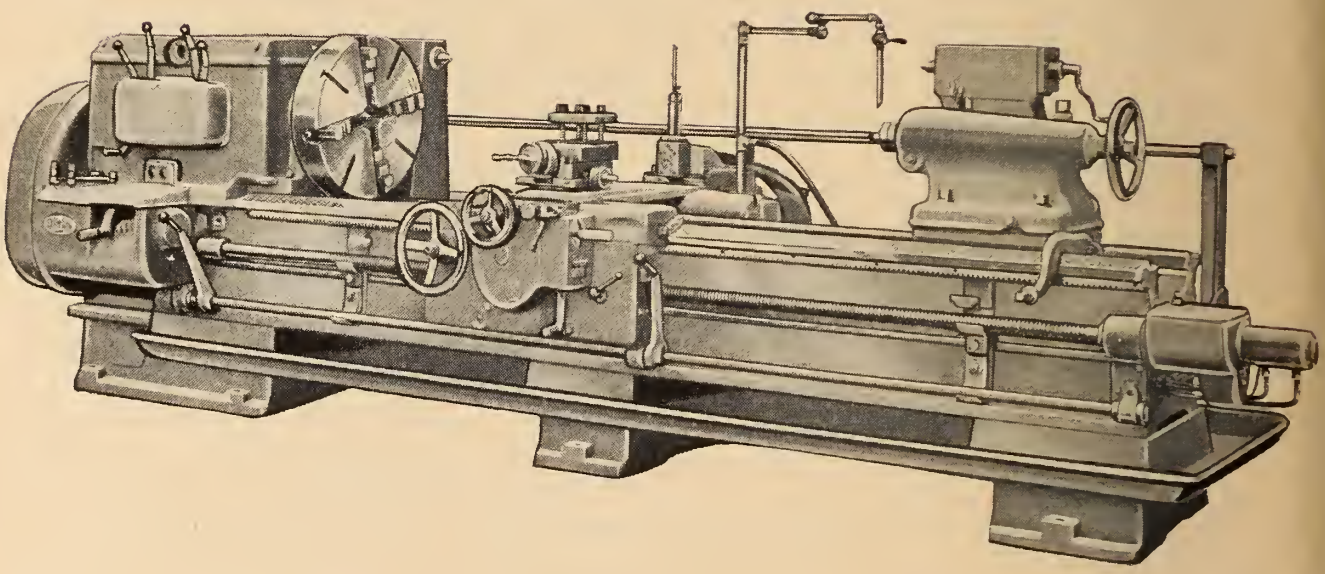

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BUSINESS AND INDUSTRIAL BRIEFS

(*Continued from page 1385*)

Plant Safety. — Plant safety men in search of a lively approach to accident prevention will be interested in four recent additions to the National Safety Council's series of job training booklets. The titles of the publications are "Steps to Safety" "It pays to Dress Well" — giving information on protective clothing and equipment — "Ship Shape" which extols the advantages of good housekeeping and "Down Time" — which recommends periodic checkups on the health of the worker.

These four 16-page booklets, printed in colour and illustrated with cartoons are offered at nominal prices. Sample copies of the booklet will be sent free upon receipt of request. Address requests to the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

●

Fine Comstock Brochure. — Canadian Comstock Company Limited, Comstock Building, 206 Laird Drive, N., Leaside, Ontario, have a new publication which coincides with the awareness of the Canadian public to the value of their new-found resources and their resulting new sense of independence.

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●

Cast Iron.—"Modern Cast Irons" was the subject of a talk presented by A. G. Zima before the British Columbia chapter of the American Society for Metals at Vancouver, B.C.

Copies of Mr. Zima's address may be obtained by writing to Nickel Information Service. The International Nickel Company of Canada Limited, 25 King Street West, of Toronto 1, Ontario.

●

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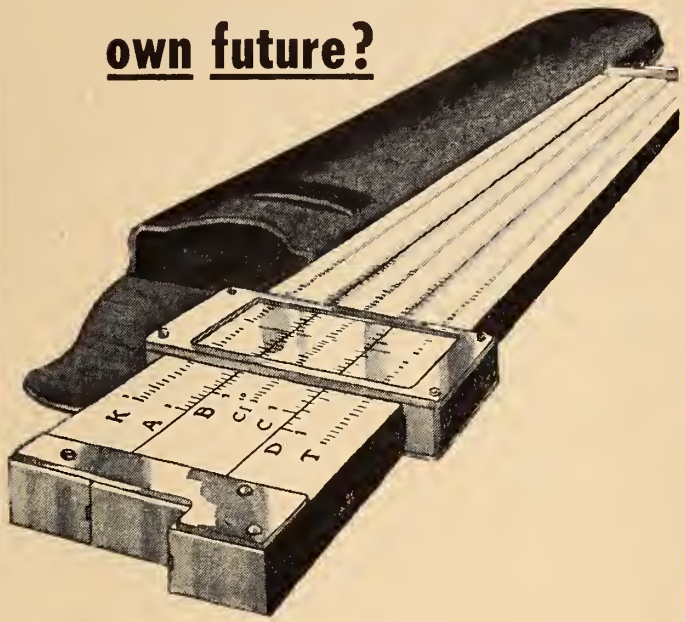

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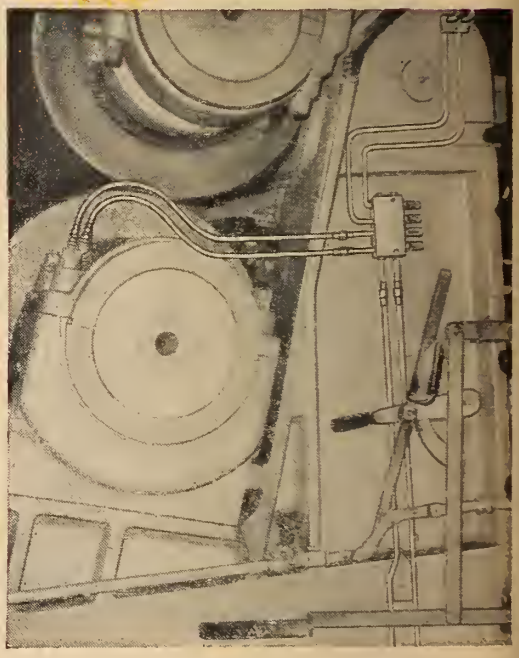

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